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ECONOMIC GEOGRAPHY

VOL. 36 JULY, 1960 NO. 3

# LABOR-SHED, EMPLOYMENT FIELD, AND DYNAMIC ANALYSIS IN URBAN GEOGRAPHY

*James E. Vance, Jr.*

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MUCH attention has been given in recent years to the complex structure of urban areas. Intra-city circulation as well as the role of the suburb as an integral part of the functional city have been investigated. It has come to be accepted that not only the residential but also the commercial and industrial segments of urban activity have shifted toward a decentralized position. A dynamic concept of city structure has grown in the minds of students of urbanism. It seems fully appreciated that the oft-mentioned urban complex is complex in change as well as constitution. Slowly we are coming to the conclusion that metamorphosis springs from factors additional to absolute growth; particularly, it would seem, from changing technology and transportation patterns. Within the field of urban geography the concern for circulatory patterns is more at home than the detailed consideration of technology. It is proposed, in this paper, to look at the influence of changing circulation within the city region on the functional structure of the area.

This paper attempts to do three things: (1) establish a system of dynamic analysis which is oriented toward handling evolving factors of urban economic geography, (2) establish a model of city structure along dynamic lines to exemplify that evolution, notably with respect to transportation, and (3) test the method of analysis and the model against actual conditions.

## THE PURVIEW OF URBAN ECONOMIC GEOGRAPHY

Classically, the study of economics has considered three aspects of man's material life—land, labor, and capital. Economic geography, and its subsumed part, urban geography, in contrast to economics has been restricted largely to a consideration of land, broadly defined, probably on the assumption that geography is primarily an areal study and consequently any economic aspect other than land is beyond the scope of the field. Such a justification obviously fails to distinguish between the scene and its components. There can be little question that economic geography must be locative in nature in contrast to the operative emphasis of economics, but at the same time an *understanding* of economic areal pat-

terns is as fully a part of geography as of economics. Such an understanding requires the comprehension of cause and operation as well as siting. An economic geography without labor and capital is one without understanding.

That geographers have shown unnecessary caution in studying in its entirety the logical field of economic geography is well brought out by an appraisal of the content of economic geographic research. There has been concern for agricultural geography out of all proportion to economic life. Even within urban geography, which could hardly share the parent field's preoccupation with agriculture, the main concern has again been with land in the absolute, that is land use. No one would contest the geographer's claim to this field, and we have chosen restricted but conceded ground in preference to the farther limit logic would grant to economic geography.

Current development in economic geography is turning away from areally restricted geography to seek advancement through a study of the labor and capital aspects of economics. Location analysis cannot overlook these other facets; in fact Stewart and Warntz[1] have suggested that population patterns are the predominant key to all economic geography through their direct relationship to labor supply and consumption of goods and services. It appears that a similar broadening of conception is necessary in urban geography. Not only must we introduce labor and capital into our analysis, but also we must learn to comprehend mobility as a factor shaping the economic geography of the city. This mobility of the urban population expresses itself both diurnally and over a long time. Both the morphological approach to city structure, characteristic of much British study of urban geography, and the functional approach, characteristic of American study, tend to produce a conceptual framework which enhances the importance of the immutable at the expense of the evolving. It would seem that a concentration on land use (either in terms of morphology or function) must of necessity obscure the time continuum which accurately portrays the history of a city and its structure. That our view of the city is a fleeting one is often overlooked.

The purview of urban economic geography requires the establishment of a system of dynamic study. In addition, to comprehend the economic life of a city, we must give more than formal acknowledgment to the part that labor and capital play in economic life. To accomplish these ends a study of the evolution of transportation within the urban complex affords us hope of establishing a conceptual framework that will help to overcome past omissions. Urban transportation is, to a considerable degree, a tangible expression of labor source, flow, utilization, and volume. In addition, if we may assume any logical relationship between productivity of industry, amount of commerce, and the economic product of residence, intra-urban transportation patterns will serve to demonstrate that relationship. Finally, transportation patterns are by their very nature mutable and evolutionary and should provide early evidence of dynamic development of the urban region. Although other aspects of urban economic geography could be found to aid in filling these gaps in our thinking about cities, it seems that only in the case of transportation within the city do we have a comprehensive feature of economic life that serves to combine

[1] John Q. Stewart and William Warntz: "Macrogeography and Social Science," *Geogr. Rev.*, Vol. 48, 1958, pp. 167–184.

these objectives in a single coherent element subject to mapping and analysis.

## The Dynamic Structure of the City

Before attempting to study the movement of people within an urban region it is necessary to establish the background of that circulation. Historically considered, the large-scale movement of people within a city is a rather recent phenomenon. Accounts of European cities or the proto-cities of colonial America before the Industrial Revolution tell us that residence and the production and sale of goods were physically related, at least occurring in the same district and often in the same building. Pre-industrial intra-urban circulation appears to have arisen from the purchasing of commodities rather than from their production and sale. Obviously, the raw materials of production had to be accumulated from outside the city, but this condition would result in exterior rather than interior connections. With the coming of industrial life, production and residence tended to become separate. Factory districts, commercial districts, and residential areas developed. The peculiar site needs of the factory and the shop conferred on appropriate locations a value which tended to rule out residence.

In the industrial areas of the city the workshop was replaced by the factory. There the provision of power required the concentration of production in a factory building and the functional unit of the "mill village" was introduced. In Lowell, Massachusetts, the opportunity to utilize a considerable concentration of water power led to the establishment of one of the first true manufacturing cities in the United States. Mills were built along the Merrimack River and water-power canals leading from it. Although successive mills established their own "villages" of workers' housing, it was not long before the tie between factory and tenement broke down and labor circulated throughout the whole complex.[2]

No doubt the initiation of a highly organized money economy brought about a specialization of economic activity with its segregation of land use. Colonial America had, outside the few proto-cities, supported little commerce. Sugar, salt, nails, glass, and a few other commodities constituted the stock of general stores. But with the coming of factory employment even everyday essentials had to be purchased and trade grew rapidly. It is interesting to note that in Lowell the business district sprang up on the island of land circumscribed by the Merrimack and Concord Rivers and the Pawtucket Canal, in close association with the pioneer mills and their mill housing developments. Thus, this "industrial" core became also the trading focus when commerce expanded out of the city into the countryside.

This same relationship existed between port or railroad station and business district in cities founded on transportation as shown in Figure 1.[3] In Marquette, Michigan, the port centered around the South Harbor at the time of founding and just inland from that point the central business district grew up.[4] When the Union Pacific Railroad laid out the town of Cheyenne,

[2] See Margaret Parker: *Lowell: A Study of Industrial Development*, New York, 1940, particularly Chapter 3, "The Evolution of the Pattern."

[3] See Raymond E. Murphy, J. E. Vance, Jr., and Bart J. Epstein: "The Internal Structure of the CBD," *Econ. Geog.*, Vol. 31, 1955, pp. 21–46; and Raymond E. Murphy and J. E. Vance, Jr., "A Comparative Study of Nine Central Business Districts," *Econ. Geog.*, Vol. 30, 1954, pp. 301–336.

[4] Robert Platt: "An Urban Field Study: Marquette, Michigan," *Annals of Assn. of Amer. Geogrs.*, Vol. 21, 1931, pp. 52–73.

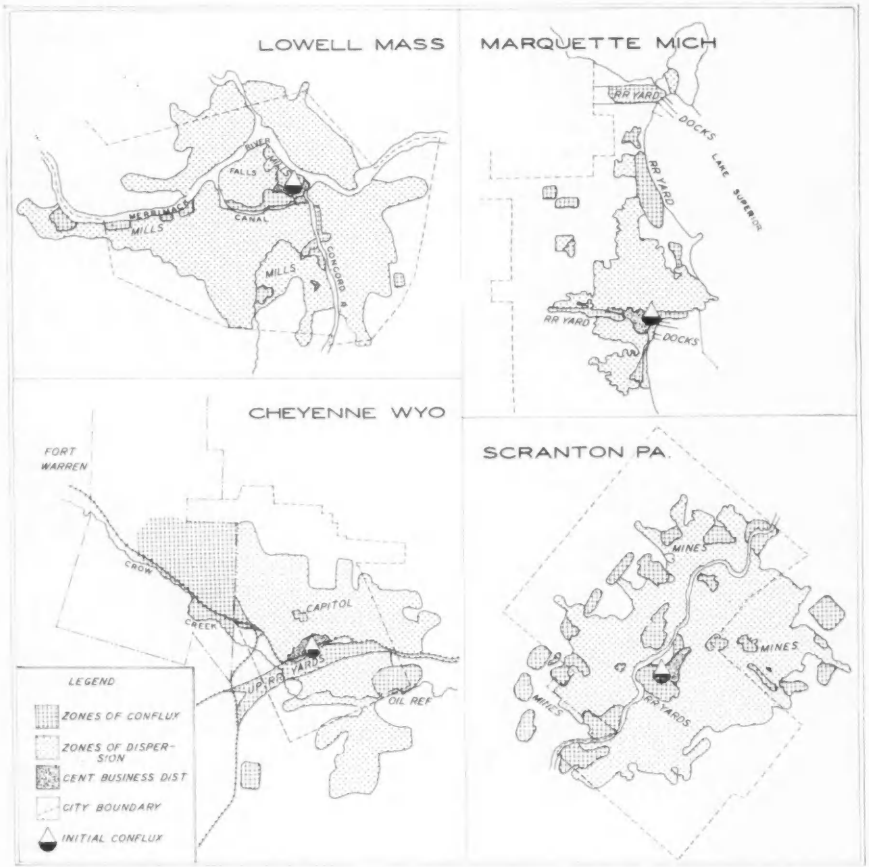


FIG. 1. The analysis of cities in terms of zones of conflux and dispersion is shown in these four maps. The "two-part" nature of the initial zone of conflux is evident in each place despite the fact that none started as a trading center. The necessity for "external" additions to industrial and transportation zones of conflux is also shown. The map of Lowell is after Margaret Parker, that of Marquette after Robert Platt, and that of Scranton after Clifford Zierer.

Wyoming, in 1867, rail yards were constructed where the railroad made its final crossing of Crow Creek. Business grew rapidly along the first street bordering the railroad. From this evidence and observations elsewhere it appears that even in towns not originally trade centers the business district tended to locate at the side of the prime economic core (port, railroad yard, factory, or mine) reinforcing the focus of circulation there.

By the mid-nineteenth century American cities were noted as having discrete districts segregated by function. It should not be overlooked that a practicable means of intra-urban circulation had to be devised to facilitate this separation in the larger cities. In the early phases of the Industrial Revolution the larger cities of the country experimented with city transportation. New York introduced horse cars as early as 1832; Boston and Philadelphia

followed shortly thereafter. Electric traction was introduced in Richmond in 1887. Boston constructed the first subway in the Western Hemisphere in 1894–1898. From the beginning of the century the horse-drawn "omnibus" had been characteristic of the larger places.

## SOCIAL AND ECONOMIC EVOLUTION

It has been shown that the average city has a core or focus stemming from the original center of the urban development. This focus has in most American cities been close-knit and multifunctional in the early stages. The colonial merchants and ship owners of Salem lived adjacent to the port and even today we may view the close physical tie between the waterfront and the rows of town houses along Federal Street built from shipping profits. Similar ties are obvious in those cities such as Charleston, Newport, Boston, and Portsmouth where reverence for tradition has tended to preserve the eighteenth century land-use pattern. But the evidence in most American cities, where tradition is lightly held, suggests that subsequent forces have existed which have been inimical to this intimate mixing of land uses. Studies such as *Yankee City* when compared with reports of the "typical" American city suggest that the more fluid social structure of the average city has resulted in a geographical succession from generation to generation to keep pace with social advancement. Residential areas move outward and the proximity between employment and residence lessens with each generation. It would seem that only where the ultimate in social position stems from historical primacy is there a freezing of the pattern of the past. Elsewhere numerous studies have shown that status in society is conferred by location of residence and that this location-caste structure changes with each generation.[5] One of the prime goals of economic advancement in our society has been the move to a "better area" and this area is truly mobile through time.

Evolution in the city must also be related to economic conditions. Not only does increasing size of cities account for this change but in addition economic evaluation plays its part. In times past it was possible for industry, commerce, and residence to be closely related in location, even though segregated, because the total area of the city was small. When we reflect that New York City, as now constituted, had a population of approximately 50 thousand in 1790 and in 1950 had a population 160 times as great, it is obvious that a vast areal expansion of the urban region has had to take place. Although cities have increased their density of development, the "gains" with respect to residential use have been less than might at first appear. The density per acre of the nineteenth century slum can be equalled today but only in tall housing projects.

The subject of economic evaluation of land in terms of location is far too complex to be considered in detail here. It should be mentioned, nevertheless, that this "value" changes independently from the growth of the city. Changed manufacturing and wholesaling procedures have created contrasting location requirements indicating sites of such a size as to be totally impracticable near the core of the city. Even in commercial land use which can pre-

[5] See Homer Hoyt: *The Structure and Growth of Residential Neighborhoods in American Cities*, Washington: Federal Housing Administration, U. S. G. P. O., 1939; and W. Lloyd Warner and Paul S. Lunt: *The Social Life of a Modern Community, Vol. I, Yankee City Series*, New Haven, 1941, particularly Chapter X, "Ecological Areas of Yankee City." Yankee City is Newburyport, Massachusetts.

empt any site on an economic basis, values change as is well demonstrated by the annihilation of the Eighth Street retail area of New York, or the malaise of the area ruled by "contractualism" as elucidated by Firey in his study of Boston during the last one hundred years.[6] Much evidence suggests that these changes are due to the growing use of automobiles rather than to the absolute growth of the city. Just as social estimation is evolutionary, so is economic valuation understandable only with the addition of a variable for time.

Though it has been impossible here to go into detail with respect to the precise characteristics of social and economic evolution, it is important to comprehend this change. The dynamic nature of the city may be caused by these technological, economic, and social forces but these are represented, in microcosm, by the internal circulation which adjusts to evolution resulting from any of several causes.

## THE NATURE OF URBAN CIRCULATION

The circulation within the city divides into several parts according to purpose. It is obvious that movement results from either the economic or social interests of individuals. Without doubt the largest of these movements is that of workers from place of residence to place of work. This is commonly called the *journey-to-work*. Another economic circulation is that of customers, both individual householders and business people, in what might be termed, in parallel, the *journey-to-shop*. Such a journey is neither so repetitive nor so predictable as the journey-to-work but in the sum of individual movements and in the concern for ease of access this circulation has more immediate economic importance than the flow of employees. Although in the past largely to and from the central business district and within residential districts, today the journey-to-shop often terminates in outlying shopping, wholesale, and office areas.

A final type of economic movement is usually of lesser extent but often of great frequency. This is what might be called *commercial circulation*; it includes both commercial contacts within a financial or other office area for routine business transaction and sales and delivery of commodities and services. Along with the journey-to-shop, commercial circulation is economically rational and provides a key to the location of economic activities, as is well shown in a study of the commercial "linkages" in Philadelphia.[7]

Social movements within the city are far more indiscriminate than those associated with economic ends. *Social visiting* in a large city with a relatively mobile population may be highly fortuitous in its geographic pattern, though a close survey would probably show a tendency in time for a contraction of individual movements into a more restricted community. *Recreational circulation*, on the other hand, is dominated by institutionalized areas of recreation either public or commercial and is more definitely akin to the journey-to-shop, at times actually part of it, with obvious influences on the location of commercial recreation facilities.

Considering these several types of city movement from a different aspect, we may distinguish between those with a collective terminus and those with dispersed termini. The journey-to-work,

[6] Walter Firey: *Land Use in Central Boston*, Harvard Sociological Studies, No. 4, Cambridge, Mass., 1947, particularly Chapter VI.

[7] John Rannells: *The Core of the City, A Pilot Study of Changing Land Uses in Central Business Districts*, New York, 1956. Particularly Chapter III, "Establishments and Their Linkages."

the journey-to-shop, and recreational circulation are all characterized by the assembly of large numbers of individuals from many geographical origins. In contrast, commercial circulation is characteristically one of dispersion, often from a center established as the focus of the journey-to-work. As has been mentioned, the movement for social visiting is entirely one of individual ties but is not necessarily patternless, as sociological studies demonstrate. In terms of city structure each of these types of circulation is a constructive force shaped by social and economic conditions. And they are largely parallel in operation. On the basis of this parallel relationship we may use a study of one type of movement to establish the shaping of the city.

## THE JOURNEY-TO-WORK AS AN INDICATOR

The several types of urban movement have received quite contrasting attention from students of urbanism. Recently the flow of people in the journey-to-shop has become an important consideration due to the increasing flexibility of movement. It is often said that we are now more mobile and thus shop more widely, but in essence this wider shopping area stems from the growth of a flexible individual transportation contrasted with a previous, and inflexible, mass transportation, rather than from absolute mobility. But so recent are the detailed data on the journey-to-shop that any historical picture is impossible. Much the same problem arises with respect to all but one of the urban circulations, that one being the journey-to-work. This movement, as the most repetitive and enduring, has been most fully recorded in the past. For this reason it is of use in the establishment of urban dynamics to look at the journey-to-work.

A recent study of San Francisco provides us with a quantitative breakdown of daily journeys in terms of purpose.[8] Although this study used a different classification from that here employed, it is possible to regroup the San Francisco figures for purposes of comparison. The main distinction between the two systems is that in this paper each journey is thought of as having a primary purpose whereas in the California study the "legs" of composite journeys may be distinguished. Because of the fact that the trip "home" combines the return from a number of different types of journey it accounts for the greatest number of trips (37.7 per cent). In terms of destinations other than "home" the journey-to-work bulks largest with 27.3 per cent of all trips, to which may be added most of the "trips to serve a passenger," a class comprising the carrying of passengers to bus stations or railroad stations (5.5 per cent), and "trips-to-school" (2.8 per cent) or a total of 35.6 per cent. Next in importance is the class "trips for recreational and social purposes" with 12.2 per cent. Shopping trips accounted for 6.2 per cent while "trips to transact business" (trips of salesmen, physicians, and the like) accounted for 4.1 per cent. Other classes were "trips to eat meals" (1.9 per cent), trips to airports and railroad stations to "change mode of travel" (1.2 per cent), and "trips for medical and dental attention" (1.1 per cent). For the purposes of this paper, it is significant that in terms of destinations other than "home" the journey-to-work accounts for by far the largest percentage of the diurnal trips.

[8] San Francisco Department of City Planning, *Daily Trips in San Francisco.* (Mimeographed report) June, 1955, p. 10.

## KATE LIEPMAN'S WORK

Although drawn from British experience, we may summarize the "causation" of the journey-to-work by citing the writings of Kate Liepman.[9] In *The Journey to Work* she divides the function performed by this diurnal tide into *topographic* and *economic and social* parts. Topographic causes of the journey-to-work include the various aspects of the physical structure of urban places which necessitate a daily movement of workers. Economic and social causes include a number of nonplace factors leading to internal circulation. Among these she cites the essential nature of the journey-to-work in the functioning of large-scale manufacturing and trade, in the widening of the labor market and the expansion of the potential for employment, in facilitating the expansion and reorganization of industry through a mobile labor force, in the caring for seasonal fluctuations in employment and the decline and replacement of certain industries, and in the accommodation of habitually mobile segments of the labor force. In addition, the journey-to-work tends to preserve the family unit when several members are employed, allowing women and juveniles to supplement the family income.

That this tide-like movement to and from work, which has come to be known as "commutation" in the United States, is essential to the functioning of an urban complex can readily be shown. It is impossible to conceive of a mass-production factory, a central business district, or a major wholesale district, without the journey-to-work. Borrowing again from Liepman, we may say that places of work become *zones of conflux* whereas city residential areas and outlying suburbs become *zones of dispersion.*[10]

## ZONE OF CONFLUX

The functional pattern of a city may be analyzed meaningfully in terms of dispersion and conflux, particularly when we seek to explain the relative location of use areas within the city. In this analysis of flow three elements are necessary. The first and most basic is the area of conflux, that section where the city derives its support, economic or institutional, basic or nonbasic, manufacturing, commercial, or organizational. It has been established that the original zone of conflux is the siting factor for the city, and, in fact, the location theory advanced by economists is primarily applicable to the area of conflux. The other parts of the city may be thought of as tributary or dependent in relation to this zone and only indirectly affected by location theory. The focusing of routes normally associated with the central business district, the lines of rail or water access implicit in many industrial locations, and the local supply of raw materials in mining towns are "locational" for zones of conflux rather than zones of dispersion.

## ZONE OF DISPERSION

The second element of dynamic analysis of urban patterns is made up of zones of dispersion. As has been suggested, these zones of dispersion are the residential areas of the central city or outlying sections which are coequal to the zones of conflux in the explanation of internal circulation but are dependent in relation to city siting.

Finally, dynamic analysis requires a consideration of the system of connection implicit in dispersion and con-

[9] Kate Liepman: *The Journey to Work*, New York, 1944, particularly Chapter II, "Functions of the Daily Movements."

[10] *Ibid.*, pp. 4–5.

flux. Under this heading of connection we are concerned both with the actual pattern of daily movement and with the *stage* of transportation. Illustrative of the latter is the contrast between the pedestrian pattern of the medieval city and the automotive pattern in the modern city. Parkins, writing about Nashville in 1930, distinguished two sections of the central business district, ". . . one is in old age; the other in the present and future. One developed in the steamboat and horse-drawn vehicular stage; the other in the automotive era."[11] Stage of transportation influences range of movement, its purpose, the number of individuals involved, and other facets of the circulations that shape urban morphology.

## Suburb and Satellite

The contrast in the application of location factors to zones of conflux and zones of dispersion requires the establishment of a sharp distinction in terminology as applied to functionally contrasting areas outside the central city. It is here proposed that the term *suburb* or suburban area should be restricted in usage to outlying zones of dispersion, politically separate from the central city. Thus we would have two types of residential areas, city residential areas and suburban residential areas. That such a distinction exists is obvious. An additional distinction is necessary in the case of zones of conflux. When part of the central city, these zones of conflux have well-fixed terminology such as business district, industrial area, and wholesaling district. But in outlying sections we often neglect to make such a distinction and thereby overlook the differing operation of location economics on primary areas which, because of their strictly economic nature, are ruled largely by location economics, and on suburban areas which are merely dependent in function and location. In the case of outlying primary economic areas it seems wise to restrict the term *satellite* to those sections that contribute to the basic support of the city. These outlying zones of conflux are important in dynamic analysis as movement is common from zones of dispersion in the central city to zones of conflux in the satellite. Such journeys-to-work would produce a movement of inward convergence only on those suburbs which are also partially satellites.

With these elements of dynamic analysis—zone of conflux, zone of dispersion, and concomitant circulation—in mind it should be possible to establish a model of urban structure which results from the forces at work in the city. Such a model may be tested for substantiation or refutation. This paper undertakes the creation of the model and the testing of its validity.

## Areal Selectivity of Growth

Before turning to the dynamic structure of the city some thought should be given to the need for any concept of urban expansion more detailed than one of uniform peripheral expansion. If we assume that every city grows around an initial nucleus (zone of conflux) which has come into existence to exploit the economic potential of a particular geographical site, we might also assume that the realization of that potential would result in simple peripheral expansion in a series of incremental rings around the urban core. Each doubling of the radius of the built-up area of the city would obviously quadruple the area within a circle of that new radius. The expansion of potential

[11] A. E. Parkins: "Profiles of the Retail Business Section of Nashville, Tennessee, and Their Interpretation," *Annals of Assn. of Amer. Geogrs.*, Vol. 20, 1930, p. 172.

urban land may be said, in theory, to be a power function of the increase in the radius. This fact quite clearly leads to an early introduction of selectivity in the use of land in successive incremental bands. Even in those instances where terrain and political conditions can be ruled out as shaping forces it is obvious that growth is areally selective. Urban and rural land interdigitates in salients on plains as well as in hill country, and these salients contain all forms of urban land use.

The selectivity of growth is related to the geographical increase in area noted above. Radial expansion so quickly enlarges the area that the linear function we associate with urban development does not create an effective demand for the quantity of potential land available. In the outer sections of the city only the "better" land need be used. This better land may, in addition to the commonly thought of physical geographical characteristics, be the product of superior urban transportation. The study of this transportation tells us more about the forces shaping the city than does the study of physical site features. Transportation is subject to continuing "revision" resulting from technological advance, new economic thinking, changing social attitudes, and reduced working hours. In concise form transportation sums these social and economic changes and expresses the result in clearly observable geographical patterns.

## A Model of Dynamic Organization

To repeat, we may say that the beginning of dynamic analysis rests with the determination of the original zone of conflux. Figure 1 shows four cities and indicates this initial sector. On the one hand as trade has been the most widespread generator of urbanism, we might logically expect that in the majority of cases a point advantageous for access from the trading area and the source of goods would become the core of the city. In many American cities, notably in the Middle West, this core was probably at the railroad station, where the receipt of freight was easiest. Thus, the typical trade center is railroad-oriented; we may look at Cheyenne as an example. Despite the fact that the city was a "railroad town" in the sense that its major support lay in servicing the railroad rather than in trade, the station and the central business district form a continuous but two-part zone of conflux. On the other hand, if the origin of the city was that of manufacturing place, mining center, port, or resort we may expect that the site of factory, center of mines, waterfront, or scenic location will "locate the city." Adjacent to this should be the central business district, and, returning to Figure 1, we find that this is the case. Factory and business district coalesce in Lowell, port and district in Marquette, and a position central to the local mining areas in Scranton is occupied by the central business district. Whether this dualism of initial zone of conflux is without exception would require further investigation; but the examples here cited suggest a strong functional tie between the initial conflux and business center.

The initial zone of conflux with its business district would logically be surrounded by a residential area, the zone of dispersion. In most American cities the founding took place when internal movement was still largely on foot. The proximity of residence and employment was essential. A ring of housing may be thought typical of these cities and the examples shown would suggest the validity of this

theory. Subsequent expansion of employment areas seems to have taken two courses. In the case of commerce, the high land values associated with trade made possible the absorption of part of the ring of housing and a change to business uses. Central business districts expanded through *accretion*. Manufacturing and transportation functions appear to have grown through *external reproduction*, probably due to their economic inability to uproot and supplant housing. In Lowell new mill villages were laid out. In Marquette the North Harbor extended the docks. New York shows a similar growth in the construction of Port Newark, Bayonne, and other outlying integrated ports. The contrast in the expansibility of commerce and manufacturing may help to explain why cities have a single central business district but often have several manufacturing districts. The future of commerce with the advent of integrated outlying shopping centers is less obvious. Although part of the development of multiple zones of conflux stems from the inability of manufacturing to absorb the original zone of dispersion, at times multiple areas result from the fact that land suitable for manufacturing may be in several dispersed areas rather than in a continuous band.[12]

With the need for exterior expansion of manufacturing the satellite came into existence. Using Boston as an example, we may say that the initial site was determined by the port, located on a tombolo extending into the broad harbor. The business district grew back from the wharves occupying much of the original peninsula. When manufacturing was introduced in New England at the turn of the nineteenth century, there was little room in Boston itself for factories. In addition the tombolo location was exceptionally poor in terms of water power. Factories had to be built away from the city. Waltham became the first textile center, soon to be followed by other satellites such as Lowell, Lawrence, and Haverhill making textiles, and Brockton and Lynn making shoes. Around each factory town a considerable population was centered and the zones of dispersion tended ultimately to coalesce into a single urban complex.[13]

It is probable that the particular civil structure of New England may account in part for the development of highly discrete satellites in the Boston area. It should be borne in mind that by the end of colonial times all the land in the three southern New England states was parcelled out among minor civil divisions called either towns or cities. Geographically the distinction between the two is unimportant, since towns and cities are equivalent in area and represent a defined and delimited civil entity with municipal powers. Unlike most parts of the United States, southern New England had a complete mesh of units with municipal powers *prior to* the advent

[12] A recent article by Raymond E. Murphy ("The Industrial Sites Inventory: An Example of Applied Geography," Handelshögskolans I Göteborg Skriftserie [Gothenburg School of Economics Publications], No. 1, 1959, pp. 125–133) describes an analysis of potential industrial sites in the Springfield, Massachusetts, area and shows strikingly, particularly in Figure 2, the dispersed nature of good industrial sites.

[13] A study of the development of suburban areas of Omaha, Nebraska, by William Baker has shown that although it has often been assumed that a large stockyard is an unfortunate neighbor, the establishment of the Omaha stockyards in South Omaha in the 1880's in open country led to the subsequent surrounding of this facility by areas of residence for the workers. Despite the fact that this stockyard is now the most active in the United States, there is no evidence that residential zones of dispersion around it are being abandoned even though today this is entirely feasible under conditions of the journey-to-work. William Baker, *Areal Growth of Omaha, with Special Reference to the West-side Area*, Unpublished Ph.D. Thesis, The University of Nebraska, 1958.

of industrialization and its consequent urbanization. Although some partition of preindustrial municipalities took place with the coming of mill villages (e.g., Lowell, Maynard, and Clinton, Massachusetts) and there was some annexation of adjacent towns by the city of Boston (e.g., Dorchester, Charlestown, and Roxbury), in general neither partition nor annexation took place. Typically, the growth of New England urban complexes was characterized by the inclusion of additional municipalities ringing the city rather than by the inclusion of land in the essential sense as in the Middle West and Far West.[11]

Although New England may be thought to have a civil-division pattern different from that of most of the remainder of the United States, we can find an equivalent development of satellites outside the central city in the Middle and Far West. This type of growth is particularly characteristic in those cases where county or state boundaries have tended to force satellitic development along the lines found in New England. Gary, Indiana, and East St. Louis, Illinois, show this well in relation to Chicago and St. Louis respectively. Oakland and Richmond, California, are clearly discrete in relation to San Francisco and each other because of county and hydrographic barriers. It appears that the scale may differ in satellite development depending on local political geography but that the basic force remains constant.

If we may assume that at first workplace and residence were in close spatial association, with the development of the central business district, the mass-production factory, or the major port it was no longer practicable for everyone to live within walking distance of his work. Rapidly, cities developed zones of dispersion that served several zones of conflux. With the establishment of multiple lines of circulation there was no longer such contiguity between the two types of zone that the nature of the connection could be overlooked. This tie of residence and work-place may be shown diagrammatically as in Figure 2.

Prefatory to a discussion of this diagram it is necessary to establish terminology. The area from which a factory or zone of conflux draws its workers is commonly called its labor-shed. But even Liepman gives no name to the area in which the residents from a particular zone of dispersion work. It is here proposed that this parallel feature be called the *employment field*.

## THE THEORETICAL STRUCTURE OF THE LABOR-SHED AND EMPLOYMENT FIELD

The conception of the city as a product of forces working to align zones of dispersion in predictable relationship to zones of conflux is nebulous and requires the construction of a theoretical diagram or model against which to test actual conditions.[13] Such

[11] For a discussion of the part played by civil division structure in shaping urban areal patterns reference may be made to the author's forthcoming article "Areal Political Structure and its Influence on Urban Patterns" to be published in the *Yearbook of the Association of Pacific Coast Geographers*.

[13] An early attempt to establish a model of "dynamic structure" was that of Sten De Geer in his book *Människans och Näringslivets Geografi* (Stockholm, 1924), where he considers the influence of travel time on the shaping of a *småsted* (village) into a *storstäd* (metropolitan city). Unlike the present study he assumes (1) the growth of a single place and the organization of subsequent suburbs around it, (2) a single zone of conflux and that primarily an *affärszon* (central business district), (3) the absence of any pre-existing areal political structure, and (4) a final stage of commutation dependent on public transportation or walking to work. This paper attempts to add to De Geer's work in (1) adding to the model a separate consideration of zones of conflux and zones of dispersion, (2) taking into consideration the influence of areal political structure,

(*Continued on page 202*)

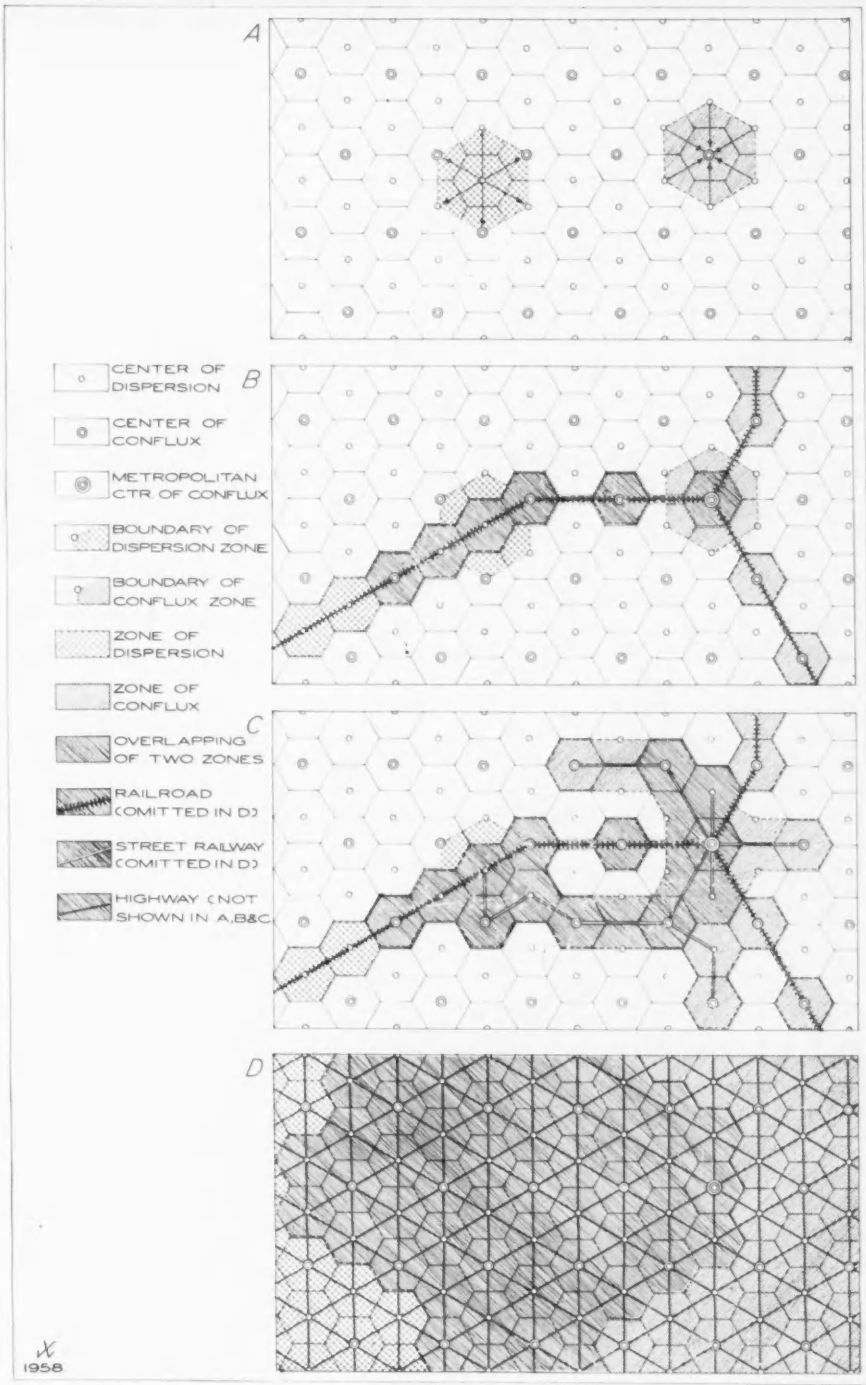


FIG. 2. The model. Growth of the zones is shown. In A the employment field of a zone of dispersion and the labor-shed of a zone of conflux appear as theorized under the influence of pedestrial commutation. In B the railroad is introduced and the growth of the employment field and labor-shed shown. In C the street railway is added. In D the ultimate "filling out" of the employment field and labor-shed is tied to the introduction of automobile commutation.

a model must attempt to rule out all variable elements other than those stemming from urban dynamics. To do so, political and terrain variability that might account for eccentricities in the pattern must be overcome. In the political realm Christaller's work has suggested a "uniform shape" for such minor political structures as might be involved in an urban complex. These regular hexagons, based on the assumptions that boundaries commonly will be composed of legs of straight lines and that no area will be outside a political unit or shared by two units, have been widely accepted as providing a framework devoid of adventitious elements. The closest figure to a circular pattern, which might seem the best arrangement of areas tributary to a center but would produce overlapping or gaps, would be this hexagon. By constructing a grid of hexagons such a "uniform shaped and sized" civil division would be secured taking political structure into account but reducing it from a variable to a constant.

Commonly in geography the plain of low elevation has been considered the typical habitat of man and certainly it may be shown that most men live in such areas and, even more, that most economic activity that produces cities is carried on in plains regions. To assume such a terrain for any theoretical model of urban dynamics seems both unexceptionable and productive of the desired end of a nonvariable terrain base.

In Figure 2 it is assumed that there is no variation in landscape or political framework. Under this circumstance the areal structure of economic activity along with the dependent urban areal structure would result from two irreducible variables: (1) absolute distance from an initial or satellitic zone of conflux, and (2) transportation technology. Obviously such a conclusion is applicable only to conditions within an urban region; not to the relation of one major region, urban or rural, to another. It must be accepted that the discussion of the initiation of urbanism is not the purpose of this paper and thus it is assumed that the seed of city development exists at the time for which the model was created.

Within an urban region distance has two facets: (1) linear departure from the initial zone of conflux, and (2) a relative composed of time and the economic cost of movement depending on transportation technology. On reflection, it may be seen that within an urban region (1) remains constant throughout time whereas (2) changes. For this reason, in a study of urban dynamics it is entirely logical to consider linear departure a time-constant and thus of little concern in understanding the history of urban structure.

## TRANSPORTATION TECHNOLOGY AT THE INITIAL STAGE

In Figure 2-A the hexagonal grid is constructed with a distance between the centers of political units that would correspond to a practicable walking or horseback journey-to-work. In the earliest of American cities such transportation was current at the time of founding and it seems reasonable to begin any model with the earliest-occurring example appropriate to its characteristic transportation technology. Such a journey might be assumed to be around six miles; some 90 minutes of walking or an hour of riding. This value of six miles corresponds well with the interval between the centers of southern New England towns and

and (3) carrying the consideration forward in time to include the part automobile commutation has played in the shaping of the urban complex. Students of urbanism and urban movement might be interested in comparing the present study and its model with that of De Geer shown on page 65 of his book.

Middle Western and Western townships which have central settlements. With a six-mile dimension to a political mesh, it may be supposed that in the beginning phase a zone of conflux would draw workers from an hexagonal area extending outward for six miles (12 miles across and 81 square miles). This area would be the theoretical labor-shed of the zone in its most basic state. Similarly, any person living at a particular place, let us assume a village, should be able to seek employment anywhere within a hexagon of the same area. To create a nonoverlapping pattern of a typical labor-shed and employment field, Figure 2-A was constructed to show these, each of the zones in turn centered on a town center. The towns themselves, being six miles across instead of 12, have areas of 27 square miles each. Although neither the employment field nor the labor-shed would be comprised totally of complete towns, due to the fact that either zone represents a hexagon of specific area centered on a nucleation rather than an assemblage of political units, it is interesting to relate these two zones to the towns in which the work is carried on or the employees live. During the time of walking and horse transportation, the employing town or the residential town furnishing workers would be one quarter the size of the employment field or labor-shed.

Further observation of the theoretical diagram will reveal that the hexagonal political pattern assumed has characteristics that result in the inclusion of six adjacent centers in the labor-shed and a similar number of work-places in the employment field of a particular place.

## Advances in Transportation Technology

The first improvement in transportation that could be utilized in the journey-to-work was the railroad, developed in England and New England during the late 1820's and the 1830's. By mid-century "workers' trains" were being run, and the diurnal movement by railroad was a reality. This being the case, we may assume that by 1850 it was possible for workers to extend their employment field beyond the previous walking zone and for the factory to push outward in its search for workers. If we may relate the morphological form of the mill village to the transportation technology of the earliest period of the Industrial Revolution, we may equally relate the origin of suburbs as we know them today to the advent of mechanical transport.

During the walking era, space was of significance mainly in an absolute sense. Within the practicable distance for daily journeys, location was relatively free of route-orientation, as movement was both individual and highly adaptable. But with the coming of the railroad this uniformity disappeared and specific locations became more important in analysis than absolute distance. A uniform landscape was not, and could not be, served by railroads everywhere. In fact, even in New England, with the nation's most dense rail-net, railroads were relatively limited in extent during this period. Railroads introduced a nonuniform element into the consideration of the economic landscape. The linearity of rail patterns spawned a linearity of settlement, of labor-shed, and of employment field. Such a linear pattern composed of hexagonal political units is shown for the railroad era in Figure 2-B. A railroad (shown by the conventional symbol) connects the zone of dispersion and the zone of conflux. The obvious result is an overlapping, in part, of the typical employment field and labor-shed along the rail line. The

two would extend beyond the central town to adjacent centers in the former walking zone, but elsewhere we may assume that the units making up the pattern would be towns (railroad stations) the centers of which would be served by the railroad. As the typical zone of conflux that might be served by two or more railroads would be favored over that served by a single line, the labor-shed for the work-place with multiple connections could be considered larger than the labor-shed for the work-place with a single connection.

In Figure 2-B, a probable pattern of labor-shed for the zone of conflux outlined in Figure 2-A is suggested for the railroad era. The expansion consequent upon the building of the railroad is obvious and the ramification of these tentacles of labor-shed is suggested along two rail lines. Under the circumstances assumed, the labor-shed would expand from the 81 square miles characteristic of the walking era to a possible 300 square miles or more during the railroad era. A similar, though smaller, expansion of the employment field might be theorized. In this case the typical zone of dispersion established during the walking era is shown with a single rail connection and the consequently smaller employment field: 250 square miles increased from 81 square miles during the walking era. In either of these cases the total areas are intended as merely suggestive of relative size.

### TECHNOLOGY ADAPTED TO LOCAL NEEDS

The expansion of cities resulting from the provision of railroads created a demand for still more labor, and for a broader labor-shed. The fact that railroads were expensive and difficult to construct and were largely oriented toward moderate to long-distance transportation led to their being supplemented by less costly rail facilities. The street railway, which could use existing streets and roads, came into existence particularly during the 1890's. As it utilized existing ways, it tended to conform more to the road pattern established in the earlier walking era than to the later pattern of railroads. Less direct routing was common for the street railway, but the ramification of lines tended to create a rather dense net. Figure 2-C shows the theoretical landscape with a street railway system added to the railroad pattern. Tentacles have been pushed outward from the previous employment field and labor-shed and a limited-to-complete radial pattern has developed. Due to the lesser efficiency of the street railway as a means of transport, absolute outward extension would not have been increased over the railroad era. Even fairly close to the center of dispersion or the center of conflux, areas unserved by railroad or street railway would have remained outside the employment field or labor-shed, as the only alternative to rail travel would have been walking, with its severe limitations.

The increase in employment field and labor-shed area in the street-railway era sprang from ramification rather than peripheral expansion. In the model, area is added but outward distance remains the same. The labor-shed of the zone of conflux has increased to 700 square miles, but the outer limit is still approximately 40 miles. The employment field is still smaller, but is up to 500 square miles from 250 square miles in the previous era.

### THE CURRENT TECHNOLOGY

The development of the automobile to the extent that ownership was widespread and service was dependable reached a stage around 1920 that permitted a return to the earliest orienta-

tion of transportation, that of individual rather than mass transport. This fact freed the journey-to-work from the bonds of restricted mass movement along rail lines. Under this situation the labor-shed would logically return to the pattern characteristic of the earliest phase, with the significant modification that the range would be greatly expanded over that typical of walking. The pattern resulting would again return to the simple situation of distance controlling the outer limit of the labor-shed and employment field. Only where railroads remained, providing fast and efficient transportation, would there be any considerable likelihood of skewing this pattern by proruption beyond a consistent outer ring. Such a railroad line and its effect is suggested in Figure 2-D, which shows the pattern theoretically developed during the automobile era.

During the automobile era the labor-shed and employment field have expanded greatly through "gap-filling." In the model the former has increased to several thousand square miles with no absolute increase in outward distance. The latter has increased more rapidly, reaching an equivalent size of several thousand square miles. This more rapid increase of the employment field is logical with the ending of dependence on mass transportation. With mass movement no longer necessary to assure transportation to an area of relatively small employment, the worker is free to take employment anywhere within a practicable daily journey.

## The Development of Work-places

In the earliest stage (Fig. 2-A) the development of work-places has been suggested. During the later stages these have been indicated. It should, however, be pointed out that, although a uniform landscape is assumed, the intervening railroad and street railway eras would have seen a considerable advantage redounding to those zones of conflux best served by rail lines. The best-served places might be thought to grow during these periods, probably at the expense of less well-served work-places. The result would be that despite the exclusion of variables other than transportation, advantageous location cannot be ruled out. In the historical sequence outlined, certain places would tend to assume predominance by the last stage. For simplicity only one place of enhanced importance has been shown.

## The Application to Urban Planning

The preceding discussion of the development of urban structure in relation to transportation implies, but does not elaborate, a situation of considerable importance to urban planning. A brief résumé of this relationship is in order.

It may be noted that the dynamic history of the city contains two contrasting "systems," one of highly permissive nature and one of equally restricting form. During the first and last of the transportation eras—pedestrian and automotive respectively—time-distance appears as the only control of urban development. The flexibility, ubiquity, and absence of any obvious, clearly defined "economic" quality in walking and operation of the individual automobile are highly permissive in relation to urban areal patterns. Each of these eras did, in its peculiar way, result in urban sprawl. The mid-nineteenth century industrial city and the mid-twentieth century metropolis exemplify the consequences. In the first case the city grew rapidly in size, consuming large amounts of rural land through a *cellular reproduction* such as we have seen in Lowell. The mill village tended to reproduce in microcosm

the original city, joining the work-place, commercial district, and factory housing in a single area. A "community" resulted that was occupation-oriented; all, from the owner to the youngest apprentice, lived in close association with the work-place.[16] But these districts spread widely over the environs of the city. If any pattern of land use was the result of broad-scale location economics, it was the pattern of the working nuclei around which the communities developed.

Between the pedestrian era and the advent of automotive transportation, sorting of land use was accomplished largely through the agency of the fixed and economically oriented rail and railway lines. Although these lines were at times built with little relation to support—that is, economically adequate demand—the financial history of the majority of railroads and the earlier street railways (those that predated the automobile, as the later railways were anachronisms when they were built) attests to their satisfying, or creating, an economic demand. Cities grew, but not haphazardly; and where that growth took place a practicable and efficient form of transportation was already available.

The automobile revived individual choice in urban circulation patterns. With it came what still seems an unbounded expansion of the city and encroachment on the rural landscape. The absence of any apparent economic measure to be applied by the individual to daily commutation has resulted in extremely long journeys as well as the proliferation of highly scattered residential areas. The location of these areas often represents not the operation of economic evaluation of time-distance or travel cost, but rather the developer's selection of sites with minimum costs of developing land for residence. Perhaps this is more precisely *urban spewing* than urban sprawling.

The permissive nature of automotive transportation has withdrawn a very real "master plan" from the control of development in American cities. Unfortunately this removal came prior to the era of effective land-use planning, so that chaos began before any police power existed to control or prevent it. Even today most planning agencies are endowed with too little power to accomplish actual planning of urban dynamics. What metropolitan agency can legally say, "uneconomic expressways will not be provided, and therefore you may not build in that inefficient location?" In the past, urban dynamics effected this restraint.

Another facet of this problem was clearly outlined by the pioneer of the Garden City satellite, Ebenezer Howard, when he wrote in 1913, "it is doubtful whether all the improvements that have been made in locomotion during the past 80 years have brought working life in point of time one minute nearer to home life than it was before. . . . The reason for these disappointing results is not far to seek. . . . It is because immediate and material results have been the chief end sought. . . ."[17] Phrased in relation to dynamic analysis, we might say more specifically that the failure to shorten the time taken by the journey-to-work results from: (1) the growth in the initial zone of conflux, usually the central business

[16] This "community" is a recurrent element in the novels describing the time, particularly in Great Britain and the United States. Arnold Bennett described the occupation-community for the potteries, J. P. Marquand did so for textiles in New England, and Ibsen for the ship-building towns of Norway.

[17] An excerpt from Howard's article, "The Transit Problem and the Working Man," is found in *The Town Planning Review*, Vol. 30, 1959, p. 25.

district, which has made the securing of an adequate labor force from nearby areas very difficult, a situation which might be justified as a necessary consequence of major urban growth; but also from (2) the fact that little thought has been given in locating subsequent zones of dispersion in logical relation to work-places, this resulting from the ability of mechanical transportation (a) to "ripen" land for speculative development farther from the city than required by prior building and (b) to increase commuting distance while not changing commuting time, and (3) the failure to appreciate that any unnecessary separation of the zone of dispersion from its predominant zone of conflux requires an uneconomic transportation input in the journey-to-work. So long as housing for workers rests solely on the initiative of private developers, it can hardly be expected that the location of that housing will result from causes other than minimum development costs. In England the "worker's train" represented a shifting, by legislation, of the economic burden of excessive commutation costs onto the general public by forcing railroads to earn their profit from freight and long-distance passenger travel. In this country a similar subsidy has been established, by regulatory agencies, for commutation trains and, by legislative appropriation, for express highways necessitated in considerable degree by unwieldy and wasteful journey-to-work patterns.[18]

Such is the problem presented to planning by the current technology and urban dynamics. An understanding of these dynamics is essential to orderly and *economic* urban planning.

## TESTING THE MODEL

The theoretical framework for dynamic analysis here suggested requires testing and substantiation. No body of information has been found that could be used to construct an historical series of labor-sheds. It seems that the general features of this labor area may be determined, but its precise extent is elusive. The mass of evidence suggests that the patterns proposed as typical of the several stages of transportation are correct. But to defend this arrangement it is necessary to find more detailed information than is available for labor-sheds. This theory of transportation-settlement relationship with respect to the employment field has been tested by field work in Massachusetts. We have noted the correspondence between the employment field and the labor-shed, and so such testing may serve *locum tenens* for a testing of both labor-shed and employment field. The employment field for Natick, one of the important suburbs of Boston, will be investigated.

## THE EMPLOYMENT FIELD FOR NATICK'S WORKERS

Settlement in eastern Massachusetts followed a town pattern with a complete coverage of the area by these towns at an early date. Within 100 years of the original settlement of Boston, in 1630, that part of Massachusetts east of Worcester had a framework of town centers and a well-developed

[18] For a discussion of the origin and nature of worker's trains in England and America see Charles Francis Adams, Jr., *Railroads: Their Origin and Problems*, New York, 1878. Lösch views this matter of costs of transportation in commutation as an individual consideration in "the maximization of profit" as "industrial workers are often faced with the question whether to live where they are employed, or whether the cost of commuting will be balanced by lower living costs and greater intangible advantages of the country such as light and air. . . ." (August Lösch: *The Economics of Location*, New Haven, 1954, p. 99). He fails to consider the effect of this individual maximization of benefit on the "equilibrium" between individual and general interests that he postulates to be the ultimate control of location. It is doubtful that in the long run only individual benefits can be taken into consideration.

agriculture. One of the earlier towns to be founded was Natick, begun as an Indian mission in 1650 and located 17 miles west of Boston on the Charles River. The advent of factory industry during the early nineteenth century affected Natick to a degree typical of southern New England. Here grew up a considerable shoe-manufacturing industry. The labor supply appears to have been drawn largely from the local farms, whose prosperity declined during the first half of the century and whose economic survival was severely questioned during the latter half of the nineteenth century. The earliest development of factories in Natick produced a pattern of labor movement typical of the horse-and-pedestrian era. Although detailed statistics are not available, considerable investigation supports the belief that the labor-shed for those factories was the town itself, an area of some 15 square miles, and a thin band of farms in neighboring towns. The employment field for Natick's residents not at work in its own work-places appears to have been an essentially equivalent and nearly coterminous area. At mid-century Natick was a typical satellite within the eastern Massachusetts industrial structure.

The railroad reached Natick from Boston in 1834, but the town experienced little change with respect to the journey-to-work. That the town remained largely a satellite rather than a suburb of Boston is shown by the fact that 50 years after the coming of the railroad no more than 2.3 per cent of the employed population of Natick found work outside the town. There appears to have been a degree of inertia that maintained the localization of employment long after improved transportation had made an expansion of the employment field possible. This inertia stemmed from several roots. One was without doubt the conservatism of the population. The availability of work in town enhanced this localization. Finally, the rail service first provided was not keyed to commutation. Figure 3 shows the train service between Natick and Boston for representative years between 1841 and 1951. It may be seen that in the earlier years the service between the two was not noticeably oriented toward commutation. No sharp clustering of eastward departures in the morning is observable until 1887. At that time we know that a sizable part of the passenger movement between the places was for the journey-to-work. In 1885, in fact, 58 per cent of all train passenger movement was for commutation,[19] but, even so, only a small part of Natick's labor force worked in Boston. The town was still to a major degree an outlying zone of conflux, a satellite of Boston.

## THE OCCUPATION OF NATICK'S RESIDENTS

In order to trace the development of the employment field for Natick and also to outline the background of growth, Table I is presented. For several years between 1882 and 1931 information is available on the place of employment for residents of the town according to type of work. As these figures are derived from town directories for the years shown, it has been necessary to generalize the categories rather than to use a standard classification of occupations. Within this limitation several conditions can be discerned.

It should be kept in mind that in the discussion of the theoretical dynamic organization of an urban region, variables other than type of transportation were ruled out. In

[19] *Annual Report, Board of Railroad Commissioners*, Massachusetts, 1885, p. 112.

TABLE I

THE OCCUPATION STRUCTURE OF NATICK'S EMPLOYMENT FIELD

1882–1951

| *Occupation group* | *Percentage of Natick's workers employed in:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Natick* | | | | | *Boston* | | | | | *Elsewhere* | | | | |
| | *1882* | *1897* | *1915* | *1931* | *1951* | *1882* | *1897* | *1915* | *1931* | *1951* | *1882* | *1897* | *1915* | *1931* | *1951* |
| Agriculture | 96.4 | 100. | 97.6 | 100. | ^ | .... | .... | 1.2 | .... | ^ | 3.6 | .... | 1.2 | .... | ^ |
| Construction | 99.1 | 99.3 | 96.9 | 96.6 | ^ | 0.9 | 0.7 | 1.9 | 0.5 | ^ | ... | .... | 1.2 | 2.9 | ^ |
| Domestic | 100. | 100. | 91.3 | 90.7 | ^ | .... | .... | .... | .... | ^ | ... | .... | 8.7 | 9.3 | ^ |
| Factory | 99.7 | 99.2 | 87.9 | 64.7 | ^ | 0.2 | 0.6 | .... | 1.7 | ^ | 0.1 | 0.2 | 12.1 | 33.6 | ^ |
| Laborer | 100. | 100. | 100. | 99.7 | ^ | .... | .... | .... | .... | ^ | ... | .... | .... | 0.3 | ^ |
| Maintenance | 94.6 | 100. | 78.1 | 87.5 | ^ | .... | .... | 1.0 | 1.8 | ^ | 5.4 | .... | 20.9 | 10.7 | ^ |
| Office Work | 96.1 | 72.3 | 52.0 | 41.7 | ^ | 3.9 | 25.8 | 29.5 | 41.7 | ^ | ... | 1.9 | 18.5 | 16.6 | ^ |
| Professional | 90.0 | 89.8 | 74.8 | 57.1 | ^ | 9.0 | 6.5 | 20.6 | 28.7 | ^ | 1.0 | 3.7 | 4.6 | 14.2 | ^ |
| Public | 82.6 | 87.5 | 81.3 | 66.2 | ^ | 17.4 | 12.5 | 14.2 | 21.8 | ^ | ... | .... | 4.5 | 12.0 | ^ |
| Public Utility | 100. | 85.7 | 87.8 | 79.3 | ^ | .... | .... | 9.7 | 4.9 | ^ | ... | 14.3 | 2.5 | 15.8 | ^ |
| Retail Sales | 93.9 | 90.6 | 88.6 | 71.0 | ^ | 6.1 | 8.3 | 6.1 | 18.7 | ^ | 0.6 | 1.1 | 5.3 | 10.3 | ^ |
| Salesman | 94.6 | 97.6 | 87.3 | 71.9 | ^ | 5.4 | 2.4 | 12.7 | 25.1 | ^ | ... | .... | .... | 3.0 | ^ |
| Semiprofessional | 85.7 | 100. | 90.7 | 83.9 | ^ | 16.3 | .... | 6.2 | 11.1 | ^ | ... | .... | 3.1 | 5.0 | ^ |
| Service Trades | 96.4 | 97.0 | 93.3 | 91.7 | ^ | 3.6 | 2.5 | 4.7 | 2.2 | ^ | ... | 0.5 | 2.0 | 6.1 | ^ |
| Transportation | 95.6 | 93.5 | 75.6 | 64.5 | ^ | 2.2 | 3.1 | 17.5 | 25.9 | ^ | 2.2 | 3.4 | 6.9 | 9.6 | ^ |
| Total percentage in location | 97.7 | 95.4 | 86.0 | 75.0 | 32.2 | 1.6 | 3.4 | 7.4 | 12.5 | 22.8 | 0.7 | 1.2 | 6.6 | 12.5 | 45.0 |

^ Indicates data unavailable by type of work but available for place of employment.

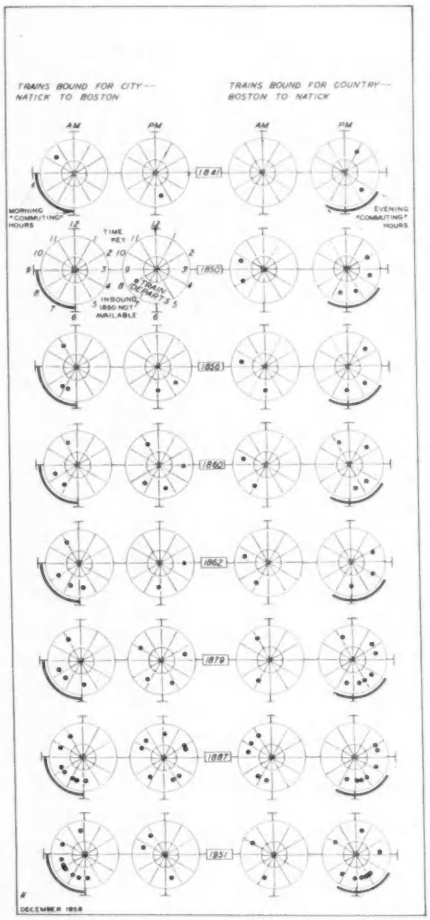


FIG. 3. Train service graphs for the Boston and Albany Railroad between Boston and Natick. Each dot represents the time of departure in the direction indicated. The graphs are 12-hour clock faces. The black bands bordering the graphs represent "commuting hours" for the direction shown. Sources: 1840 from *The Christian Science Monitor*, April 16, 1951; 1850 from a Boston and Worcester RR timetable in the Railway and Locomotive Historical Society library, Harvard University; 1856 from an advertisement in *The Natick Observer*, May 7, 1856; 1860 from *The Natick Observer*, February 10, 1860; 1862 and 1879 from *Appletons' Railway and Steam Navigation Guide*, July, 1862, and February, 1879; 1887 from *The Natick Citizen*, May 11, 1887; and 1951 from the timetable for the Boston and Albany Railroad, September 30, 1951.

actuality, of course, these variables do intrude. Geographical uniqueness cannot be overlooked, since there are ports, central places, power sites, and the like. In the case of eastern Massachusetts, Boston from its founding was the political, economic, and population center of its region. It was the largest zone of conflux from colonial times. Its attraction for workers was commensurately great. And for certain occupations the city afforded the main source of employment. For this reason, it is important to add the type of work to our study of the employment field. Much as we have avoided this variable in the discussion of the theoretical movements, we cannot do so in actual practice. Table I helps to establish the influence of occupation on the journey-to-work.

From the table it may be determined that certain occupations have been the ones most commonly practiced in Natick itself. In 1882 the town was a satellite and it is not surprising that construction workers, factory workers, and transportation labor were largely employed there. Boston, as the central place, was of importance in public employment (mostly the state government), professional, semiprofessional, and retail sales occupations. It must be observed that although the latter three are ubiquitous functions in an urban region, the concentration of employment in the central city will be felt in each. In successive years the notable features are the slow decrease in the percentage of employment found in Natick and the increasing importance of Boston in sales work of all sorts, office work, professional employment, and transportation labor. Equally striking is the slow decrease of factory labor predominance by Natick. To understand this shift it is necessary to remark that the slow decline of the archetypical

industries of southern New England, textile and shoe manufacture, affected Natick greatly. During the depression of the 'Thirties the shoe industry collapsed; and if comparable data were available for 1951 it is doubtful that over one-quarter of the factory work would have been found in the town. The establishment of dominance by a few of the best-founded zones of conflux tended to reduce local employment both relatively and absolutely. What remained to the town were the predominantly ubiquitous functions: local retailing, local professional and other services, general labor, and construction.

Although occupation data are not available for 1951, extensive field work in the town at that time justifies the conclusion that the status of the town as a zone of conflux had largely disappeared. Part of this disappearance stemmed from the offering of alternative work-places through an expansion of the employment field as a result of automotive transportation, but part stemmed from a shift in the economic composition of the population. With the large-scale move to the periphery so typical of the post-World War II period, Natick enjoyed (or suffered, if you prefer) the largest percentage increase in population of any of the suburbs of Boston, increasing in ten years approximately 100 per cent from 15 to 30 thousand. People moved to the town not to work there but to live there. In truth, the situation was one of a zone of conflux overpowered and submerged in a zone of dispersion.

## THE SHAPE OF THE FIELD

Turning to the physical shape of the employment field, shown in Figure 5, this change of Natick from work-place to living-place is equally plain. Although the railroad had not assumed great importance in 1882, its part in the shaping of the field is plain. At that time work outside the town was found only in those municipalities along the railroad from Framingham in the west to Boston in the east. The neighboring towns off the railroad provided no employment, substantiating the theory that where railroads were not available, no more than a walking zone would be available for work-places. This is significant in that towns north and south of Natick had moderate-sized factories in 1882. Figure 5-A shows Natick's railroad-era employment field.

## STREET RAILWAY FIELD

With the coming of the street railway in 1885, the pattern began to change. Still predominantly a satellite depending on factory employment, the addition to the employment field in the early part of the street-railway era (as shown for 1897 in Figure 5-B) was Wayland, the town to the north of Natick, where work was found in several shoe factories along the street-car line, and an additional town to the west along the railroad, Westborough, where similar factory employment existed. The height of street-railway development in Massachusetts was at the time of the first World War. The map for 1915 serves to show the conditions at that time (Fig. 5-C). By then the limited radial pattern theorized for trolley transportation was evident. Three towns to the south of Natick, each accessible by car-line, were added to the town's employment field. Six places to the north of Boston and one to the south that could be reached by radial lines from Natick or Newton also came into the employment field. The last railroad to be built in this section was completed in the 1880's, so that it seems probable that the car-lines rather than railroad facilities account for this expansion. Again, most of the towns added were

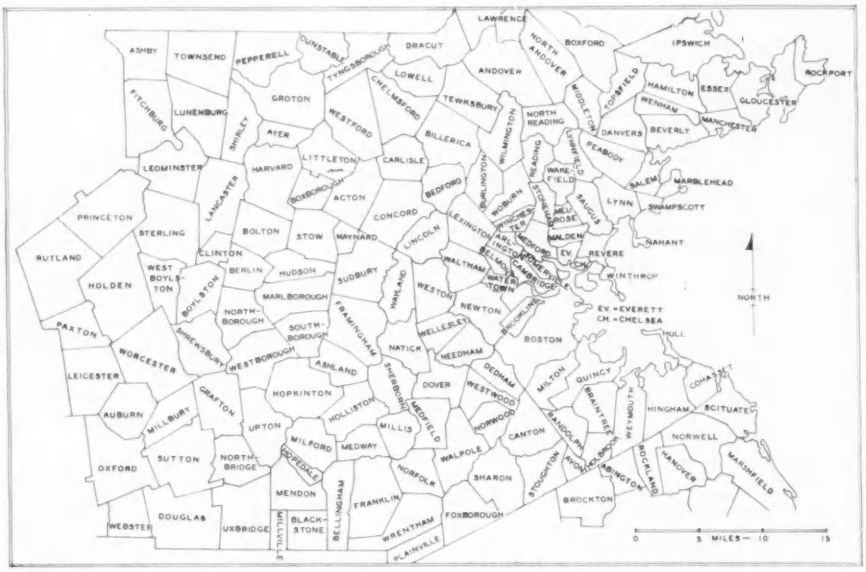


FIG. 4. Identification map for towns and cities of eastern Massachusetts shown on Figure 5.

highly industrial (Waltham, Watertown, Chelsea, and Quincy) and would have been logical places of employment for workers living in a dying satellite.

### AUTOMOTIVE FIELD

The automobile came into prominence as a medium for the journey-to-work in the 1920's. To survey the early effect of car travel, the employment field for 1931 is shown in Figure 5-D. Although the general features of this pattern are discernible in 1915, certain important additions are seen. The "gaps" tended to fill, the outer boundary was pushed farther from Natick, and fairly distant zones of conflux such as Worcester, Maynard, Milford, and Canton came into the field. These distant zones were highly industrial; and we see the shift of the town from satellite to suburb strengthened. We may be fairly certain that the changes in place of work sprang, as far as transportation was concerned, from the use of automobiles. Most of the street railways outside Boston and its immediately adjacent municipalities were abandoned by 1931, and few of the additions to the employment field in 1931 were practicably approachable by train.

From a local census of the town[20] conducted by the author in Natick in 1951 it is possible to determine the means of transportation used by workers in reaching their work-place. Figure 6 shows the pattern established on means of transport for the journey-to-work from Natick. It is shown that the changes in employment field, its peripheral expansion and the filling of gaps, resulted from the increased use of automobiles in the journey-to-work. Of the 78 towns in the 1951 employment

[20] This "census" was in the nature of a nearly complete "sample"; 80 per cent of the households in the town were canvassed. Although random in nature, there is strong evidence that no bias in the sample resulted from artificial preference in the selection of respondents.

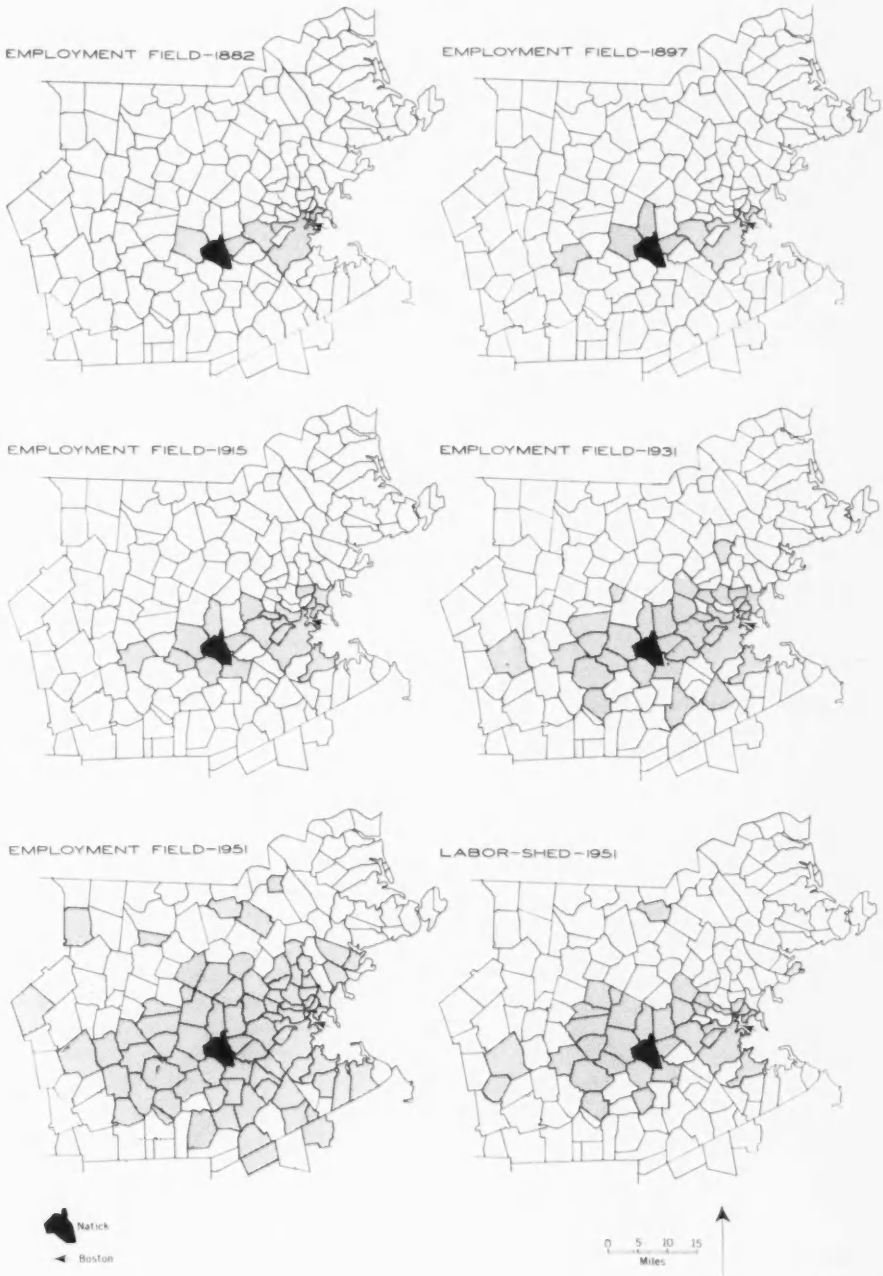


FIG. 5. Employment fields and labor-shed of Natick. (For place identifications see Figure 4.)

TABLE II

THE SIZE OF THE EMPLOYMENT FIELD OF NATICK

| *Period* | *Stage of transportation* | *No. of towns* | *Area in sq. miles* | *Area index* | *Population* (year)* | *Population index* |
|---|---|---|---|---|---|---|
| Up to 1850 | Walking and Horse | 1 (1850) | 15 | 1.00 | 4,200 (1850) | 1.00 |
| 1850–1885 | Railroad | 5 (1882) | 110 | 7.33 | 399,800 (1880) | 95.19 |
| 1886–1900 | Early Street Railway | 7 (1897) | 147 | 9.80 | 628,039 (1900) | 149.53 |
| 1901–1920 | Late Street Railway | 18 (1915) | 251 | 16.73 | 1,179,761 (1915) | 280.41 |
| 1921–1940 | Early Automotive | 29 (1931) | 440 | 29.33 | 1,620,977 (1930) | 385.94 |
| 1941–Present | Mature Automotive | 78 (1951) | 1,189 | 79.26 | 2,862,241 (1950) | 681.48 |

*Due to the fact that employment data are unavailable by place of employment it has been necessary to substitute total population of the employment field for employment totals in that area. Some rough measure of the expansion of employment opportunities is, however, secured through the use of total population for the minor civil divisions within the expanding employment field.

*Sources:* Number of towns from analysis of Town Directories, 1882, 1897, 1915, and 1931, and from local census 1951; area from United States Census, 1940; population from the state or federal census closest in time to the year of the employment field study.

field, all but 14 were reached solely by car. These 14 were in every case reached by car but also by bus, and in two cases additionally by train. It appears that the bus was used in a manner strikingly similar to the use of its lineal predecessor, the street railway. Movements from two centers of dispersion may be noted, one from Natick to the towns north, west, and east of it, and the other from Boston to the towns to the north and south. In the case of rail travel, no more than Boston and Brookline at the eastern end of the railroad were involved. This fact appears to stem from the orientation of commuter trains completely to the east in the morning that is shown on the train-service graphs in Figure 3.

## ZONES OF EMPLOYMENT FIELD

For a suburb located toward the periphery of the urban complex, such as Natick, it is logical that the pattern of transportation zones shown in Figure 6 should have its long axis radial from the central city. The alignment of rail lines in most urban areas is radial from the central place so that the direction of rail commutation would be equally radial, and linear. Bus routes, though generally forming a rather dense net over the area, would be *practicable* for the journey-to-work in two type locations: in the area adjacent to the suburb, and at the center of the urban complex where the greatest frequency of service and the greatest number of radiating lines might be anticipated.

The full stature of Natick as a suburb was established by 1951. The influx of population was accompanied by a continuing reduction of local employment to less than one-third of the total. Most of the local employment that remained was in local-service enterprises and professions. The effect of a decline in local employment should, according to the theory proposed, greatly expand the employment field even if no addition were made to the town's population. The increase of population added to declining local work may have accentuated the spread of the field, but it can be stated that in-migration of residents implied that Natick was practicable as a place to live for those working in a wider area. In 1951 the town's employment field closely paralleled the limits of the Boston urban complex. In addition, major distant industrial satellites such as Fitchburg, Lawrence, and Lowell were added. The pattern for 1951, shown on Figure 5-E, suggests that those places in eastern Massachusetts

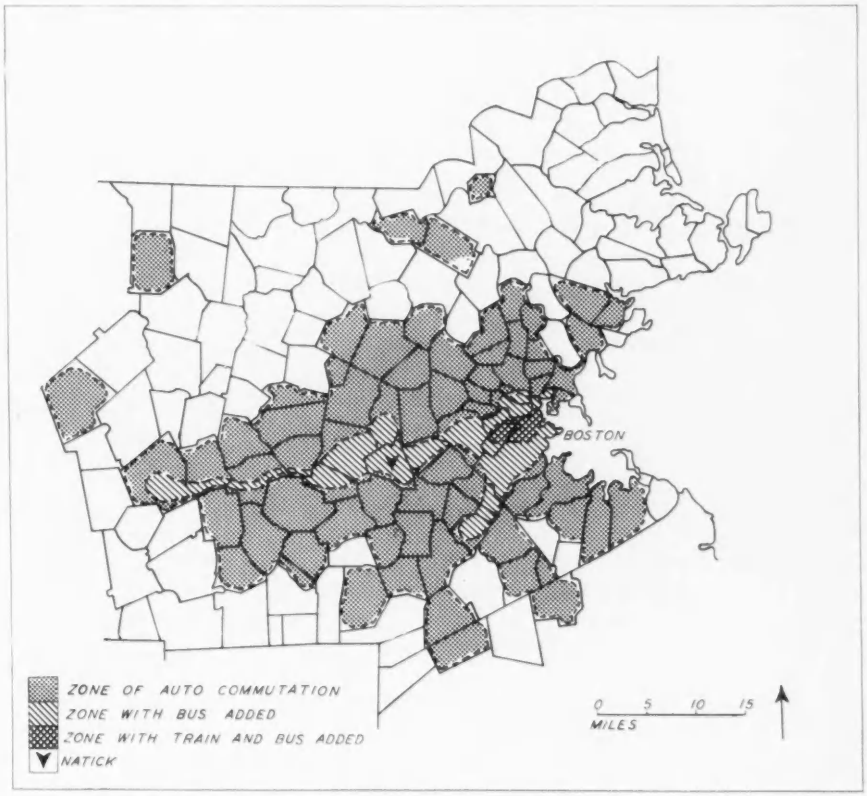


FIG. 6. Transportation zones of employment field, Natick, 1951.

possessing large amounts of employment became a part of the employment field. In addition, all places within the urban complex entered the employment field because of the presence of some employment even in suburbs.

It has been suggested that the first pattern taken by an employment field is that of a small amorphous zone surrounding the center of dispersion. The present pattern appears to be that of a *large* amorphous zone. This contrast suggests a difference in size rather than form and requires some degree of measurement. If we take Natick as an example, it is probable that, up to about 1850, the town's employment field coincided with its political extent in broad measure. The expansion of the employment field is shown in Table II in terms of the towns included and their characteristics of size and population.

## INTENSITY OF CONNECTION

One final aspect of the employment field that deserves attention is the intensity of connection within that area. The several "zones" established on the basis of type of transportation used to reach the work-place from Natick in 1951, shown in Figure 6, provides us also with a measure of intensity of connection. Out of a total of over 2200 workers represented by

the sample, 85 per cent used automotive transportation, 11.5 per cent used the bus, and 4 per cent used the train. The train was used for commutation to Boston and Brookline only. Fourteen towns were reached by bus and all 78 towns in the employment field, including those reached by train or bus, were connected through automotive commutation. In no case did public transportation provide more than a minor part of the total journeys-to-work. Table III shows the percentage division and total journeys for the 14 towns accessible by more than a single means of travel. It should be noted from this table that Natick and the towns around it, together with Boston and two of its neighbors, were the main area in which public transportation was of any significance. Several factors probably account for this pattern. Employment within Natick and Wellesley in particular is characteristically that of some other member of the family than the head. It would seem that superior bus service, added to this employment of juveniles and women, accounts for the greater use of the bus there than in other areas. In the case of Boston, it would seem that the congestion of the central city, the high cost of parking, and the availability of considerable employment for women are the factors encouraging the use of public transportation. For Boston itself, the good rail commutation available in 1951 undoubtedly encouraged many men to use the train in the journey-to-work.

## THE PRESENT EMPLOYMENT FIELD

This breakdown of the employment field by means of travel suggests that in 1951 the characteristic transportation medium used by Natick residents was the automobile. The shape of the field was certainly established through automotive commutation. Only the central city area with its concentration of employment and its long established bus and train routes seemed to provide a sufficiency of work and an adequacy of public transportation to engender considerable mass transport journeys-to-work. Outward from the major axis of public commutation, the line east-west through Natick between Worcester and Boston, there was little travel other than by car. Although the railroad was used in commutation to

TABLE III

MEANS OF TRAVEL IN JOURNEY-TO-WORK, NATICK'S WORKERS, 1951

| *Municipality* | *Auto/Per cent* | | *Bus/Per cent* | | *Direct bus available?* | *Train/Per cent* | | *On Boston and Albany RR* |
|---|---|---|---|---|---|---|---|---|
| Cambridge | 97 | 94.2 | 6 | 5.8 | No | .. | .... | No |
| Worcester | 15 | 93.4 | 1 | 6.6 | Yes | .. | .... | Yes |
| Newton | 82 | 92.1 | 7 | 7.9 | Yes | .. | .... | Yes |
| Wayland | 10 | 90.9 | 1 | 9.1 | Yes | .. | .... | No |
| Natick | 418 | 86.2 | 67 | 13.8 | Yes | .. | .... | Yes |
| Ashland | 36 | 85.7 | 6 | 14.3 | Yes | .. | .... | Yes |
| Brookline | 30 | 85.7 | 4 | 13.3 | Yes | 1 | 2.0 | Yes |
| Framingham | 290 | 85.3 | 50 | 13.7 | Yes | .. | .... | Yes |
| Somerville | 9 | 81.8 | 2 | 18.2 | No | .. | .... | No |
| Norwood | 4 | 80.0 | 1 | 20.0 | No | .. | .... | No |
| Boston | 559 | 78.2 | 69 | 9.7 | Yes | 87 | 12.2 | Yes |
| Chelsea | 3 | 75.0 | 1 | 25.0 | No | .. | .... | No |
| Wellesley | 103 | 73.1 | 38 | 26.9 | Yes | .. | .... | Yes |
| Westborough | 2 | 66.6 | 1 | 33.3 | Yes | .. | .... | Yes |
| Totals | 1,658 | 82.9 | 254 | 12.7 | Yes 10<br>No 4 | 88 | 4.4 | Yes 9<br>No 5 |

For the location of cities and towns refer to Fig. 4.

no more than two places, most of the municipalities reached by public transportation were on the Boston and Albany Railroad. It would appear that this linear pattern of mass commutation may have been established at a time when rail travel was more common than at present. The influence of direct bus service seems to have been of more importance in determining the means of transport than the shape of the area thus served. Seventy-one per cent of the places reached by bus had direct service from Natick. In fact, 83 per cent of the places with this direct service had actual bus commutation.

In terms of intensity of commutation, the 14 towns included in the group with more than one type of transportation accounted for 91 per cent of all employment, despite the fact that no more than 15 per cent of all travel was by public carriers. Obviously, there was a correspondence between desired connection and the availability of bus service, but it seems highly indicative of the current decline of public transportation that, even where available in efficient service, mass transportation was little used. Even though we may assume that public transportation was impractical in most of the 64 towns in the completely automotive zone of commutation, it is revealing to find that in that zone where actual use of public transportation attested to its practicality, over nine-tenths of the workers still traveled by car.

## PERIPHERAL EMPLOYMENT PATTERN

The grading of the journey-to-work in terms of intensity with a core near the place of residence and less commonly reached zones outward from the center has been shown in a recent study of labor movement in the Boston area. In a study of firms located along the major circumferential highway around Boston, Massachusetts Route 128, Burtt concluded that the evidence "would seem to indicate that commuting distance alone is a major factor in labor supply. But commuting distance is . . . related to where the workers live."[21] In addition he concluded that patterns of labor flow established by manufacturing plants located in downtown Boston did not transfer to the same plant in a suburban location. "The answer seems to be found, at least in part, in the limitations of . . . commuting facilities. Commuter train schedules in the morning and afternoon are designed to meet the needs of suburbanites working downtown, not downtown residents working in the suburbs, . . . and bus connections to suburban points are irregular, inconvenient, time-consuming or non-existent. Automotive commutation is feasible but costly. . . ."[22] "The general weight of opinion of the personnel managers seemed to support the conclusion that the skilled male worker was more likely to have an automobile and the mobility to seek out the best job with less concern of commuting distances, at least within the greater Boston area."[23]

In relation to the previous comments about the location factors affecting factory siting it is interesting to note Burtt's finding that, "In most of [the firms studied] it appears as if the principal determinant of the new site was the availability of specific parcels of land that could provide space for expansion, or for the efficient consolidation of operations."[24] The importance of

[21] Everett J. Burtt, Jr.: *Labor Supply Characteristics of Route 128 Firms*, Research Report No. 1—1958, Federal Reserve Bank of Boston, 1958, p. 11.
[22] *Ibid.*, pp. 12–13.
[23] *Ibid.*, pp. 15–16.
[24] *Ibid.*, p. 20.

the availability of land seems borne out by his findings that in a two-year period it was possible for plants employing over 11,000 people to locate outside previously existing zones of conflux and secure adequate supplies of labor. It was possible, if you will, for a new labor-shed to be carved out of a pre-existing surburban zone of dispersion.

The information secured from the study of Natick would tend to contradict several of Burtt's conclusions. The small importance of public transportation shown in Natick contrasts with the larger importance assigned in the study of the employees of Route 128 firms. The use of automobiles by Natick residents appears to be a matter of choice rather than necessity. The explanation of this contrast may well rest with the difference between an employment field for a central city (Boston) and one for a suburb (Natick). Burtt points out that less than two-thirds of the families in Boston have cars.[25] In contrast, in Natick virtually all those of employable age own cars. In addition, the suburban status of Natick indicates an economic and skill status for most of the town's residents higher than that of Boston residents. Within this middle and upper group, Burtt cites increased individual mobility,[26] thus supporting the conclusions drawn from the study of Natick.

## THE FUNCTIONING COMPLEX

If we accept the fact that an urban complex is an economic unit and has been so from the earliest industrial times, with outlying factory satellites tied through corporate control, selling and buying, and interest to the central city, it is important to note that the automotive era has witnessed the creation of a functional unit tied together by intimate daily contacts of one part of the periphery with another as well as the perpetuation of old ties between the periphery and the core. These ties between parts of the outlying area are of recent origin, as is shown on the maps of the employment field. It seems that the core city has served as the highest-order center throughout most of industrial time, but that beyond that relationship compartmentalization of the urban complex has been characteristic until recently. Superimposed on these compartmental circulations there has been a general circulation focussing on the core for specialized services. By breaking down the compartmental organization within the complex, automotive transportation has made the geographical city an intimately tied economic and functional agglomeration, but has tended to make it also a loose and poorly organized physical unit.

## THE LABOR-SHED

As a final test both of the parallel development of labor-shed and employment field and of the metropolitan-wide circulation introduced by auto commutation, the labor-shed of employers in Natick in 1951 is plotted here. This labor-shed, shown in Figure 5-F, is smaller than the employment field, as we might expect in the case of a suburb, but the general shape and pattern conforms to the theoretical model proposed. Natick's labor-shed is approximately half as large as its employment field, 33 towns compared with 78. This fact alone would tend to substantiate the classification of the town as a suburb rather than a satellite.

## NATICK AS AN EXAMPLE

The choice of Natick as an example of the operation of dynamic analysis is justified by the town's high stage of

[25] *Ibid.*, p. 24.
[26] *Ibid.*, p. 25.

development during all of the major transportation epochs in American experience. It was served by the railroad at an early date and was in an area where local railroading, rail commutation, was fully exploited. Later the street railway as a means of local transportation was thoroughly developed there. During the initial period of automotive transportation, Natick was located on one of the earliest of the dual highways to be built in the United States passing between Boston and Worcester. Finally, the town has been both a satellite and a suburb, affording evidence of the working of both conflux and dispersion.

The conclusion seems established that the employment field and labor-shed are related in shape and general size. The models of dynamic organization of an urban complex represent, basically, actual conditions as evidenced by this study of eastern Massachusetts. Linearity characterized the railroad era, ramification the street railway era, and gap-filling and peripheral extension the automotive era.

## A Study of the Total City

One of the more serious problems faced by urban geographers is that of studying in its totality the functional geography of the city. Studies of commercial, industrial, and residential functional districts have been undertaken and have yielded much information about these areas. The techniques and terminology of Proudfoot[27] and Murphy and Vance[28] with respect to urban commercial districts have been widely adopted. These techniques have tended, however, to focus attention primarily on the business districts themselves and only secondarily on other districts and their ties with the business districts. Similar limitations might be noted with respect to work dealing with industrial and residential districts. There is a notable absence of work attempting to establish a unifying concept for urban geography. What unity, functionally considered, has been achieved has resulted from studies of single cities as exemplified by Hartshorne's study of Minneapolis–St. Paul.[29] But these single-city studies fail in a different but equally important way to accomplish the creation of a unifying concept of urban geography. They attempt to portray the uniqueness of an individual city just as the functional district studies attempt to portray the uniqueness of a district. In fairness it may be said that neither type of study sets out to present a unifying concept. But at the same time the absence of a conceptual framework which might be used in relating urban functional districts or *comparing in their totality* several cities has restricted the advance of urban geography as a field. In proposing a conceptual framework for analyzing the growth and development of urban areal structure, it is hoped at the least to point up this need for thoughts and techniques leading to an understanding of the total city and the contrast among total cities.

## The Conception of Dynamic Analysis

Persistently a concern of geographers, methodology must enter into any consideration of results. As has been suggested, any discussion of methodology must begin with the conception of the field and its problems. Unfortunately, too few geographers have

[27] Malcolm Proudfoot: "City Retail Structure," *Econ. Geog.*, Vol. 13, 1937, pp. 425–428.

[28] Raymond E. Murphy and J. E. Vance, Jr., "Delimiting the CBD," *Econ. Geog.*, Vol. 30, 1954, pp. 189–222.

[29] Richard Hartshorne: "The Twin City District: A Unique Form of Urban Landscape," *Geogr. Rev.*, Vol. 22, 1932, p. 431.

concerned themselves with the process of conceptualizing the problem, choosing instead to launch immediately into a battle of technique with indistinct or unlimited problems. Typical of this procedure, which is inadvertently, but all too aptly, called an *approach* in contrast to the more desirable *attack* on a problem, is the presentation of idiographic regional and "industry" studies in the geographical literature. These too discrete studies have defied summation and broad analysis because, in the main, they lack a stated conceptual framework that may be understood, evaluated, and amplified. As McCarty[30] has suggested, description does not deserve the bad name it possesses in geographical writing. But what we might term "absolute description" oriented toward no mental goal, properly in this case a conception of the purpose of the description, is deserving of little regard. This paper, though mainly descriptive, intends the information presented as a test of a conception of urban structure.

This conception is fundamentally simple and unsophisticated: that the city is the result of forces within which time is an important factor and the attempt to study urban patterns must include a temporal dimension. This dimension is contained in analysis which seeks to establish the "dynamics of place" in the sense of forces at work shaping the city, and sorting and segregating its functional parts. A proposal has been made here that development of urban transportation serves to delineate part of the dynamics of place. Other parts await consideration, notably with respect to the operation of various economic systems on cities, the influence of political-areal structure on urban growth, and the geographical expression of social change. It should be noted additionally that no single study of transportation development can hope to establish all of the forces shaping the city. If this paper has succeeded in introducing a true consideration of the dynamic in the study of urban geography, it is important to recall that Crowe called for such an introduction over twenty years ago.[31] Unfortunately, few have followed his advice.

## ACKNOWLEDGMENTS

The author wishes to express appreciation to the Geography Department of the University of Nebraska for assistance in the preparation of this study in its initial phase.

[30] H. H. McCarty: "An Approach to a Theory of Economic Geography," *Econ. Geog.*, Vol. 30, 1954, pp. 95–101.

[31] P. R. Crowe: "On Progress in Geography," *Scottish Geogr. Mag.*, Vol. 54, 1938, pp. 1–19.

# SANTO DOMINGO DE LOS COLORADOS—A NEW PIONEER ZONE IN ECUADOR

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*The authors of this report were members of the United States delegation to the Fifth Consultation on Geography of the Pan American Institute of Geography and History which was held in Quito in January, 1959. During the consultation they took the opportunity to make the trip to the western base of the Andes and to spend two days in field study of the Santo Domingo area.*

IN many parts of Latin America new pioneer zones are appearing. In each case pioneer settlement has followed the construction of a highway. The postwar road building programs, supported by loans from a variety of sources, are opening up new areas which were previously unoccupied or only thinly occupied. Unfortunately, not all these new pioneer zones have been examined in advance by land classification experts, nor have they been properly surveyed. In some cases disaster can be predicted with confidence. In other cases the outcome is not at all certain. In January, 1959, the authors of this paper were able to examine one of these new pioneer areas in Ecuador, and to gather the information for this report.

Santo Domingo de los Colorados is located at the western base of the Andes, about 45 miles in a straight line to the west of Quito, and a little less than one hundred miles southeast of Esmeraldas (Fig. 1). The low country to the west of the Andes in Ecuador is made up of a mixture of low hills and flat valley lowlands. Where rivers emerge from the high Andes, they bring down vast quantities of volcanic material, and this material is accumulated in huge fans along the western base of the mountains. One of these fans directly east of Guayaquil has the effect of confining the drainage of the whole Guayas Basin in one narrow channel as it finds its way out to the Gulf of Guayaquil. Farther to the north there are other similar fans. Santo Domingo is situated near the apex of a fan that spreads out from where the Río Toachi emerges from the Western Cordillera. Where this fan borders the mountains opposite the end of the Toachi Valley the elevation is about 1800 feet above sea level.

Santo Domingo is also just about on the divide between two major drainage basins. The Río Toachi itself is a tributary of the Río Blanco which in turn is a tributary of the Río Esmeraldas. Just to the north is the Río Guaillabamba, another tributary of the Esmeraldas, the headwaters of which are eroding the ash fill of the Quito Basin. Where the Río Toachi crosses the fan slope, it has cut a flat-floored trench which is between one and two hundred feet below the surface of the fan. The Santo Domingo settlements are on the undissected fan slope, several miles west of the trench of the Río Toachi (Fig. 2). Draining this fan

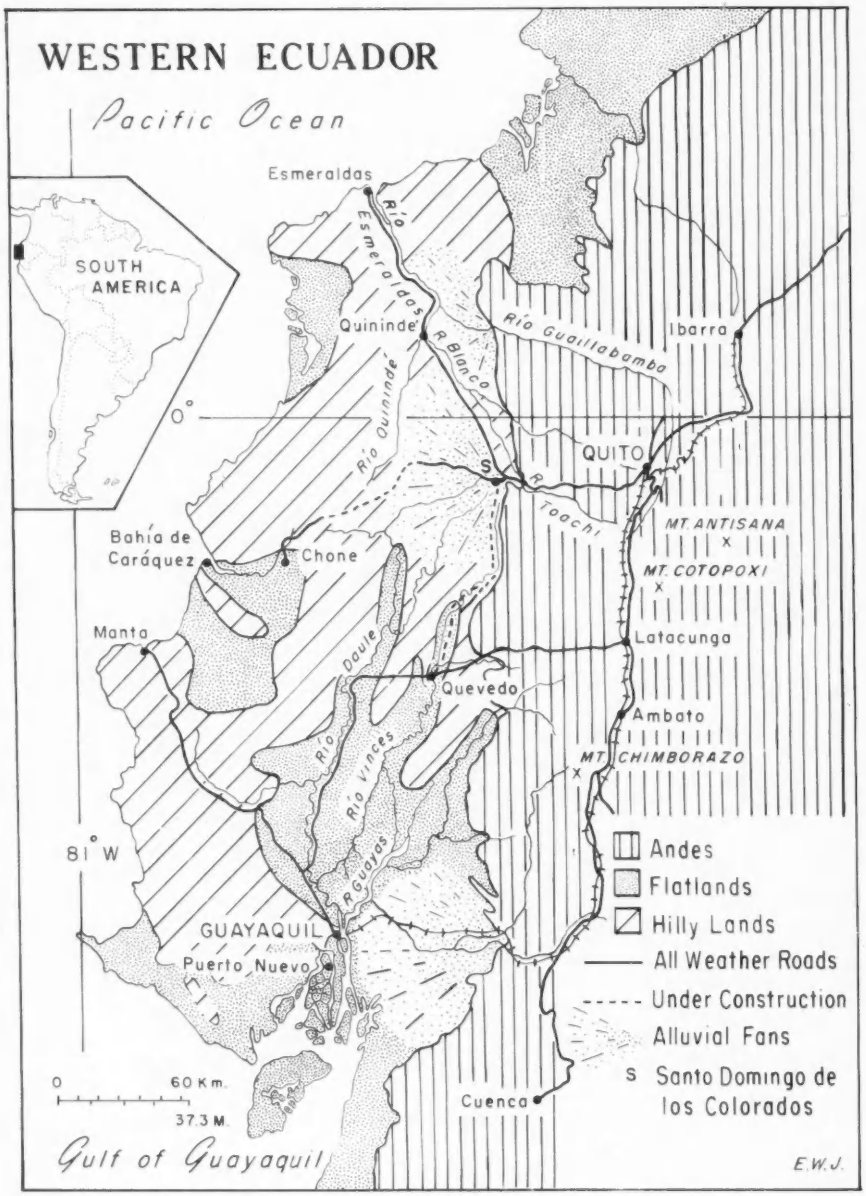
WESTERN ECUADOR
Pacific Ocean
SOUTH AMERICA
Esmeraldas
Río Esmeraldas
Quininde
R. Blanco
Río Quininde
Río Guayllabamba
Ibarra
0°
QUITO
S
R. Toachi
MT. ANTISANA
MT. COTOPOXI
Bahía de Caráquez
Chone
Manta
Río Daule
Quevedo
Latacunga
Ambato
MT. CHIMBORAZO
Río Vinces
R. Guayas
81° W
GUAYAQUIL
Puerto Nuevo
Andes
Flatlands
Hilly Lands
All Weather Roads
Under Construction
Alluvial Fans
S Santo Domingo de los Colorados
0 60 Km.
37.3 M.
Cuenca
Gulf of Guayaquil
E.W.J.

FIG. 1.

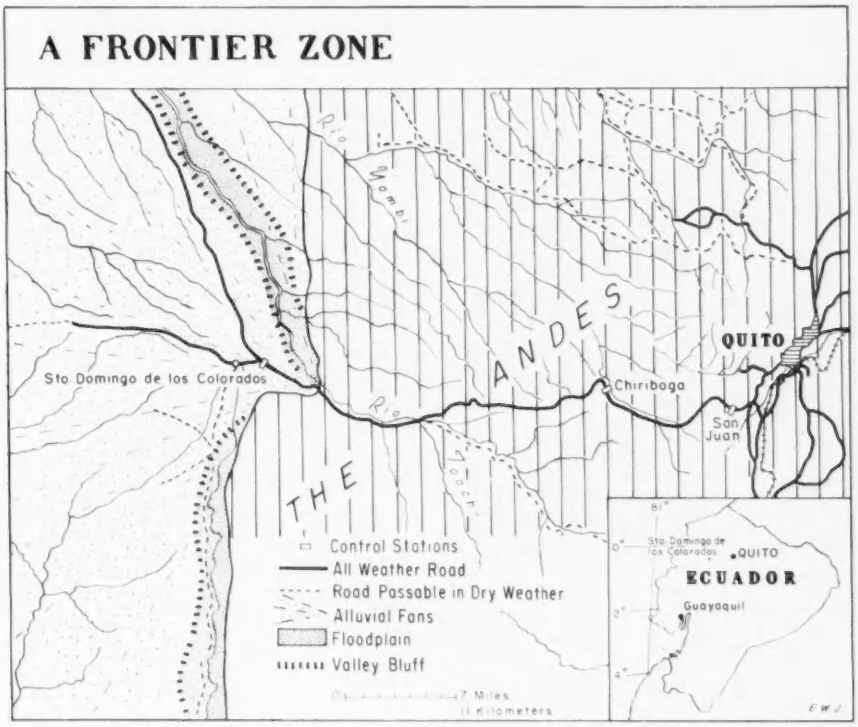


FIG. 2.

slope are the headwater tributaries of the Río Guayas—the Vinces and the Daule.

The northern part of the low country west of the Andes, where Santo Domingo is located, receives abundant rainfall. The annual average is between 60 and 80 inches, with a concentration of rain between January and April, but with no truly dry season. Throughout the year there is much cloudiness and frequent showers. In the rainy season the showers are often torrential. There are never any strong winds, and the humidity is very high, especially in the early mornings. The vegetation is a tropical rain forest which, until recently, had been little modified by human action.

## ACCESSIBILITY

Santo Domingo has long been connected up-valley to Quito. It started as an outpost of the highland settlements, quite completely isolated from either Esmeraldas or Guayaquil. But the western slopes of the Andes are very steep and rainy, and the mule trail to the western lowlands was narrow, winding, and frequently blocked by slides. Contacts between Quito and this remote outpost were few. In the forest around Santo Domingo, the Colorado Indians were able to maintain their way of living, protected on the one hand from the encroachment of people of Spanish descent from either Quito or Guayaquil, and on the other

from competition with the Negroes around Esmeraldas.[1]

In 1947, however, the isolation of Santo Domingo ended. One of the first new highways to be built in Ecuador after the war ran westward from Quito. It climbed to a pass over the Western Cordillera about 11,000 feet in elevation and then descended in a straight-line distance of less than 35 miles to an elevation slightly below 2,000 feet. The road is narrow and winding, and the greater part of it is open only to one-way traffic. There are three traffic control stations (*Cadena de control*) which hold all traffic until on-coming cars and trucks have passed by. Thus all traffic between any two stations moves in the same direction at a given time. It takes a truck some four to five hours to make the trip. The immediate result of the opening of this road was a movement of new settlers into the forests around Santo Domingo.

Santo Domingo remained tied to Quito. All the products of the new pioneer zone were sold in Quito, and from Quito came all the supplies for the lowland settlers, even the food. Imported machinery, or Diesel oil for the electric generators, all came through Guayaquil. Goods are still carried across the Río Guayas to the eastern bank where the railroad has its terminal. Goods are carried by rail to Quito, some 9300 feet above sea level, and thence by truck down again to Santo Domingo. Supplies of all kinds are brought by the truckers, and the pioneer settlers in the lowlands purchase what they need from the truckers instead of from retail merchants in Santo Domingo.

In 1949, however, a new road was opened up in the lowland. This road was hacked through the rain forest to Esmeraldas. Almost at once a string of new pioneer settlers, with bananas as their chief product, appeared along the road. There is now a ribbon of banana plantations some ten miles wide running from Esmeraldas to Santo Domingo. However, the road lacks one bridge, where it crosses the Río Quinindé. Trucks carry bananas to Quinindé (Rosa Zárate), where the bunches are loaded on river barges. Esmeraldas itself has no docks, and the bananas are transferred to lighters that carry them to the ships lying at anchor off-shore. Transportation to Esmeraldas is so costly that the bananas of the Santo Domingo area are still marketed in Quito.

From Santo Domingo another road has been built in the direction of Chone and Bahía de Caráquez. This is an all-weather road only for a short distance to the southwest, and here pioneer planters are also established. Trucks can reach Chone in dry weather, and cattle can be driven thence throughout the year.

A new loan from the International Bank of Reconstruction and Development (1958) makes possible continued highway development in western Ecuador. The bridge will be built on the road to Esmeraldas, and the highway will be surfaced with gravel to Chone. Even more important, however, is the new black-top highway now under construction to connect Santo Domingo southward with Quevedo, and thence along the existing highway to Guayaquil. This road is to be completed in 1960, after which it will be possible for trucks to go all the way to Guayaquil in five hours. This new highway will

[1] R. C. Murphy: "The Littoral of Pacific Colombia and Ecuador," *Geogr. Rev.*, Vol. 29, 1939, pp. 1–33; *idem*: "Racial Succession in the Colombian Choco, *Geogr. Rev.*, Vol. 29, 1939, pp. 461–471; E. N. Ferndon, Jr.: "Studies in Ecuadorean Geography," *Monographs of the School of American Research*, No. 15, School of American Research and University of Southern California, 1950, pp. 57 and 61.

FIG. 3 (upper left). Rock slide on highway to Santo Domingo. (Photograph by A. L. Burt.)

FIG. 4 (upper right). The Quito–Santo Domingo road is so narrow that there can be one-way traffic only. At three points traffic is held until all vehicles moving in the opposite direction have passed. This is the middle one of the three control points. (Photograph by A. L. Burt.)

FIG. 5 (lower left). Trucks loaded with bananas from Santo Domingo on the road to Quito. (Photograph by A. L. Burt.)

FIG. 6 (lower right). Small settlement along the road between Quito and Santo Domingo. Cooking is done in the street outside the house. (Photograph by P. E. James.)

probably bring Santo Domingo into the service area of Guayaquil.

What have these changes in accessibility meant, and what will they mean, in terms of the process of pioneer settlement?

## PIONEER SETTLERS

As soon as Santo Domingo was made accessible to the Quito market in 1947, pioneer settlers began to move in. Most of them were Ecuadoreans who lived in either Quito or Guayaquil, and who had accumulated enough money or could borrow enough money to buy land. This previously isolated area had never been divided among private owners. The land was sold by the *Instituto Nacional de Colonización* for about 5 sucres per hectare.[2] Many of the well-to-do Ecuadorean owners continued to live in Quito or Guayaquil, and left their new plantations to the care of managers. There were, however, four pioneer settlers who came from Idaho in response to an advertisement published in the United States setting forth the opportunities of this new area.

The new landowners or managers proceeded to develop their lands in about the same way. Workers were hired to clear the forest. On newly cleared land the first crops were maize and rice. In the second year some of the land was seeded to pasture grass

[2] The sucre in 1959 was valued at 6.3 cents, or just under 16 to the dollar.

FIG. 7. One of the pioneer settlers from Idaho in Santo Domingo. (Photograph by A. L. Burt.)

and used for grazing cattle, and some was planted with bananas. Cattle and bananas are still the most important products, but since the bananas could only be sold in Quito and since the price received for bananas in that market suffered a decline from 5 to 3 sucres per bunch, some of the planters have been experimenting with other crops, especially cacao and coffee.

One of the North American pioneers who was interviewed told of his own experience (Mr. Leal Scott). In the first place he had had no previous training in tropical agriculture, yet this lack of preparation did not seem to have handicapped him. Mr. Scott came to the area in 1948 and purchased 400 hectares at 5 sucres per hectare. With 15 hired hands he has cleared 200 hectares. His first crop was maize, followed by pasture and bananas. At first the workers he hired were Negroes, but he has now changed to the employment of highland Indians, and he finds them much more efficient and dependable. When he found the price of bananas dropping, he decided to try planting cacao and coffee, selling both of these crops in the Quito market. In the past four years he has planted 40 hectares of cacao, and from this small plantation he nets a substantial income. So profitable has the production of cacao become that Mr. Scott sold all of his cattle in order to concentrate his limited supply of workers on planting more cacao. He reported that it took three years and cost about 60,000 sucres to develop his 40 hectares of cacao trees. He finds that coffee can be harvested in alternate weeks, and can be dried with the same equipment as cacao, and for this reason he is also increasing his coffee area. At present he has 80 hectares still in bananas, and 65 hectares of idle pasture. He has 40 hectares of cacao and 15 hectares of coffee. Pioneering, for Mr. Scott, has proved quite profitable.

## THE AGRICULTURE

In the Santo Domingo area as a whole a fairly uniform land-use pattern has appeared. More land is in pasture than in all crops combined. The maize is found chiefly on the newly cleared lands around the margins of the pioneer zone. The chief commercial crops are bananas, coffee, and cacao.

### *Bananas*

Within a radius of about 40 kilometers of Santo Domingo there are now some 10,000 hectares of bananas. This was described as the easiest plantation crop to raise, since the plants grow with little care and yield well. Except for its isolation, this area has proved to be almost ideal banana country. The porous soil,

derived from the eroded volcanic ash, together with the excellent drainage of the fan slope, mean that this district is not troubled with too much water. Even after a torrential downpour there is little standing water to be seen and there is little of the area that is waterlogged. There are no violent winds to blow down the plants, and usually there is plenty of rain to keep the crops green.

The banana planters are organized in the *Asociación Nacional de Bananeiras Equatorianos*, an independent agency. The agency makes short term loans to planters at 8 or 9 per cent to pay for new planting or for improvements. Although the Panama Disease has not appeared in this area yet, Sigatoka has appeared and has affected most of the plantations. The Association undertakes to spray the plantations by airplane, charging the planters 1.5 sucre per bunch.

The area around Santo Domingo, and for some 40 kilometers away from Santo Domingo along the road to Esmeraldas, sends its bananas to the market in Quito. The bunches are sent by truck up the mountain road. The trucker, who acts as middle man, used to pay 5 sucres a bunch; but with the rapid increase of banana planting the price has now dropped to only 3 sucres per bunch, which is scarcely enough to pay a profit to the growers. Bananas sent by truck and river barge to Esmeraldas are sold there to the United Fruit Company, which pays 19 sucres per bunch. The cost of transportation, however, cuts heavily into the profits, and in the neighborhood of Santo Domingo is too expensive to make this outlet attractive. Shipping by way of Esmeraldas involves also the possibility that a large proportion of the bananas will be rejected by the Company because they are improperly formed or damaged in shipment. In this case the grower pays the transportation and gets nothing at all for his product. Esmeraldas is considered a poor market.

The planters around Santo Domingo are eagerly awaiting the completion of the new highway to Guayaquil. Although the distance is greater than to Esmeraldas, the road will be paved and trucks can move faster. However, bananas still are transferred by river barge from Guayaquil to ships lying at anchor in the Gulf of Guayaquil. The United Fruit Company is not yet certain of continued banana shipments from Ecuador and has not yet agreed to build banana loading docks.

The plantations around Santo Domingo were at first very productive. Mr. Scott reported that from his 80 hectares of bananas his weekly production was never less than 500 bunches, and was sometimes as high as 1500 bunches. With the spread of Sigatoka disease, however, yields have declined, and with the drop in price in the Quito market, many planters have stopped cultivating their plantations. It is the general opinion in Santo Domingo that if the United Fruit Company does not build docks and in other ways stimulate the increase of banana cultivation, this form of production may not prove to be permanently profitable.

### *Coffee, Cacao, and Oil Palms*

Several other commercial crops have been or are being tried out in the Santo Domingo area. Sugar cane is an old crop, located chiefly along the valley bottom within the mountains. Coffee is another crop that has suffered wide fluctuations of value, but is still important in this area. The newest experiments are with cacao and oil palms.

Coffee has long been grown high on

the mountain slopes on either side of the old mule-trail to Quito. But the decline in market price for coffee which has hit all the coffee-producing countries of Latin America, has resulted in the abandonment of many of these older plantations. Only a few planters continue to cultivate their trees. In the Santo Domingo area, however, new coffee plantations have been laid out, in part because the cultivation of this crop fits so excellently into the cultivation requirements of cacao. Coffee is not considered a good risk for bank loans at the present time.

The most profitable crop at present in the Santo Domingo area is cacao. As in the case of bananas, the physical conditions are ideal for cacao. In most cacao areas of the world, the trees are carefully shaded and protected from wind. But around Santo Domingo the prevailing cloudiness, the high humidity, and especially the absence of drying winds combine to make possible the growing of cacao without shade. In fact, Leal Scott reported that he was careful to keep his cacao trees pruned to permit a free circulation of air around them. This, he indicated, helped to protect the tree from the fungus diseases that are so common among the cacao plantations elsewhere in Ecuador. He uses two pounds of fertilizer around each tree (16–32–16), and sprays three times a year. The pods are harvested every other week throughout the year, alternating with the picking of coffee. Each of his cacao trees produces four pounds of dried cacao per year.

The drying of both cacao and coffee raises a problem. It takes five or six days to complete the drying process properly in the open air. The same drying platforms can be used for both coffee and cacao in sequence; but in both cases the cloudiness, humidity, and lack of wind makes drying uncertain. Some of the cacao and coffee planters have ordered kiln drying apparatus, which must be shipped in to them by way of Quito.

Both coffee and cacao are sent to the domestic market in Quito. The cacao is combined with sugar and milk to make chocolate candy, for which there is a steady demand. Santo Domingo cacao does not reach the export market; and if it did it might prove to be too expensive to compete with cacao from Ghana or Brazil. The opening of the highway to Guayaquil may not mean much to the cacao planters.

An entirely new venture involves the planting of oil palms to provide Quito with much needed supplies of cooking oil. Small areas have been devoted to palms, but before the oil can be sold processing machinery must be imported at considerable expense. In January, 1959, the machines were on order and great hopes were expressed that the product could be sold profitably in the Quito market.

*Domestic Animals*

The chief export product of the Santo Domingo area is cattle. The cattle cannot climb to the highlands and compete there with highland animals. But cattle are trucked or driven on the hoof to the Indian communities of the coast around Chone and Bahía de Caráquez. Some cattle are exported through Esmeraldas. Presumably the export of cattle would be considerably increased by the completion of the highway to Guayaquil.

Cattle are the chief interest of the Ecuadorean owners. In many cases the animals are of fine quality. Mostly one sees good-quality Holsteins or herds of native cattle improved by breeding with Holstein. There is one ranch stocked with Brahmin cattle, and

at least one owner has recently brought in high-grade Hereford beef cattle. The pastures are of planted grass—mostly Yaragua Grass from Colombia, or *Gamalote*. The pastures are good enough so that the animals are sold directly from the fields, and do not have to be fattened for market. The presence of ticks requires that all animals be dipped or sprayed. But it is reported that cattle diseases are under control and that the herds are in good shape. One serious problem has to do with the fencing of the pastures. Fence posts must be replaced every two years, so rapid is the decay of wood in this climate.

The area has in it, also, an uncounted number of hogs. Unlike the cattle, hogs are given no care at all. They are allowed to breed and run wild, securing their own food supply from the uncleared forests or from the banana plantations. Hogs provide a steady source of income, however. Six months after a pig is born it is ready to be marketed, at which time it will bring from $25 to $30 in cash.

## LABOR

When the first pioneer settlers came into the Santo Domingo area after 1947, the workers they hired to do the hard work of clearing the forest and doing the first planting were Negroes. The Negroes had reached this part of the coastal lowlands from Esmeraldas, having come originally from Colombia. They are the ones who had been panning some of the streams to the north of Esmeraldas for gold, or practicing a shifting cultivation in the rain forests. As subsistence cultivators they had been successful, but as hired laborers working for wages they proved inefficient and not very dependable.

At present most of the work is done by Indians from the highland basins. They have descended from the high, cold villages and farms, more than 7000 feet above sea level, where the chief foods are barley and potatoes, to the humid, warm lowlands, where the chief foods are maize, rice, and manioc. Contrary to the often-expressed opinion that highland Indians do not adjust easily to lowland conditions, these workers have proved far more efficient than the Negroes and have largely displaced the latter.

There are two chief systems of employment. In some cases the workers are paid wages (between 10 and 15 sucres per day), and—in the traditional Ecuadorean manner—are given plots of land on which to grow their own food crops. The more usual way, however, is for the planter to deduct 4 sucres per day from their wages and then to supply the workers with food. On an average the Indian worker gets 12 sucres per day, from which 4 sucres are deducted. He is furnished a barracks in which to live, and he is fed meals prepared by a hired cook. It is the 8 sucres per day net pay that attracts the Indian to this pioneer area from the crowded communities of the highlands. The Indian commonly returns to the highlands in December and remains there until April to aid in harvesting the highland crops. After the harvest he returns again to the same plantation in the lowlands.

The health conditions in the lowlands are something of a problem. The widespread use of DDT did for a time reduce the number of malarial mosquitoes. But it seems that the mosquitoes have developed an immunity to DDT: in 1958 there was a serious epidemic of malaria around Santo Domingo. The health authorities are struggling with a problem that has become serious throughout the American low latitudes.

## SUMMARY

At Santo Domingo, then, a new tropical pioneer zone came into existence and grew rapidly as soon as it was made accessible to a market. Pioneer zones do not develop on the basis of a purely subsistence economy; and the establishment of a commercial economy is dependent on all-weather roads, and on relatively low costs of production. Santo Domingo does possess the physical qualities of soil, slope, drainage, and climate, to support successful planting of a variety of tropical plantation crops provided other requirements are met. Presumably the completion of the new road to Guayaquil will give Santo Domingo access to an exporting port in which it can compete successfully with other parts of lowland Ecuador.

But whether lowland Ecuador in general, and Santo Domingo in particular, can sell their products profitably on the world market depends on more than the physical qualities of the habitat alone. The cost of placing bananas or cacao on the world market include, in part, the costs of transportation to a port, the costs of loading these products on ships in the port, the quality of the products, and the volume of production. A few hundred planters fanning out from Santo Domingo might not produce a large enough volume of bananas or cacao to pay for the construction of expensive docks, or to pay for many essential services in the producing area that have the effect of reducing costs—such as ground spraying, fertilizing, providing health services, or providing electric power. In the same region, where a few hundred planters might remain high-cost producers, thousands of planters might become low-cost producers.

At the moment such a wave of new settlers cannot be forecast for the Santo Domingo area. In the world picture, the small pioneer farmer or planter is a high-cost producer, and as such makes no contribution to the problem of the world's food supply. Even the development of Santo Domingo as a producer of high-quality, low-cost beef could best be accomplished by a large-scale operation, not by relatively small ranchers, producing only enough beef for the markets of Manabí around Chone. The future of this new pioneer zone is dependent on the completion of roads; but on much more than this, for to compete on the world markets the settlers of Santo Domingo must be reinforced by many newcomers who together can support a truly large-scale operation.

# THE INDUSTRIAL GEOGRAPHY OF MODERN POLAND

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THE years of Communist rule and planned development, since the end of the Second World War, have seen a great expansion in mining and industrial activity in Poland. It is the object of this paper to use recent Polish official sources to trace the nature, extent, and geographical distribution of this recent industrial growth.

## Historical Background

This increase has, indeed, been so great that it overshadows the earlier development in these fields, and we tend to forget that Poland is not a newly industrialized country. The territory of modern Poland includes some areas that had been lost to the Polish state from the thirteenth century until their recovery in 1945. These are approximately the western *województwa* of Gdańsk, Koszalin, Szczecin, Zielona Góra, Wrocław, and Opole, and part of that of Katowice (Fig. 1). The rest of the country was partitioned between Prussia, Austria, and Russia in the later years of the eighteenth century. These fragments were reunited and formed part of the Polish Republic, as it was constituted in 1918. East Prussia, however, was regained only in 1945, and now forms approximately the *województwo* of Olsztyn.

During the late eighteenth and early nineteenth centuries, when the expansion of industry in Western and Central Europe was most rapid, Poland was politically divided. Before the Partitions there had been some development of mining, especially of nonferrous metals, of ironworking, and also of certain luxury industries, which, however, found only an unpropitious soil in which to grow. After the Partitions, further growth was conditioned by the needs and the policies of the occupying powers.

Progress was most marked in Prussian-occupied Poland. Here there had long been a developed textile industry in the small towns which lay along the foot of the Sudety, especially in Jelenia Góra, Kamienna Góra, and Nowa Ruda, and some of this activity spilled out into the Silesian plain.[1] The Lower Silesian coal field at Wałbrzych and Nowa Ruda was, to judge from the volume of the literature devoted to it in the West, one of the more interesting in Europe. The lead and zinc production was rivaled only by that of the Ardennes, and in Upper Silesia the servants of the Prussian government were building that complex of coal mining, ironworking, and lead and zinc smelting industries which a German writer described in 1842 as "the equal of England and foremost on the continent of Europe."[2]

The smelting of iron with coke was introduced successfully into Upper Silesia in 1796. Already there were

[1] W. Rusiński: "Tkactwo lniane na Śląsku do roku 1850," *Przegląd Zachodni*, Vol. 5, part 2, 1949, pp. 639–666.

[2] *Berg- und Hüttenmannische Zeitung*, Vol. 1, 1842, p. 58.

FIG. 1. Poland, showing current administrative divisions. The cities of Warszawa and Łódz rank as *województwa* (provinces). Kraków, Poznań and Wrocław are not *województwa*, but are shown in the statistics separately from the *województwa* in which they lie.

English-built pumps at work in the mines and English technicians in the ironworks.[3] Almost until the mid-nineteenth century, Upper Silesia held greater promise than the Ruhr. Thereafter, its rate of industrial expansion slowed down. The resources of the Ruhr, though no greater in volume, were more easily exploited, and, furthermore, they could command the growing market of Northwestern Europe. Industrial expansion in Upper Silesia, lying, as Goethe had described it

> "Fern von gebildeten Menschen, am Ende des Reiches, . . ."

was inhibited by its location on the eastern border of Germany, by its relative lack of water communications, and, above all, by the tariff barriers erected by Austria and Russia. Although industrial growth in the Western Territories never lived up to its earlier

[3] Norman J. G. Pounds: *The Upper Silesian Industrial Region*, Slavic and East European Series, Indiana University, Vol. 11, 1958, pp. 31–33.

promise, it nevertheless continued throughout the nineteenth century.

Russian-held Poland never showed such promise as Prussian-occupied Poland. Nevertheless, the immense, slowly developing market of the Russian Empire attracted industries to Poland, which was at the same time accessible to western capital and skill and for much of the nineteenth century within the Russian customs boundary. In the 1820's Lubecki and Staszic, ministers of the Russian government in Poland, planned an expansion of industry, primarily of ironworking, in the Łysogóry area (*woj.* Kielce), but their ambitious schemes were ended by the failure of the 1830 insurrection and the more repressive Russian rule which followed.[4] Not long afterwards the textile industry, equipped largely with German capital and skill, came to Łódz,[5] then spread along the railroad that ran northeast to Warszawa—the only standard gauge railroad in the Russian Empire—and to Białystok, on the line from Warszawa to St. Petersburg.[6]

Early in the nineteenth century an iron industry had been established in the Dąbrowa District, within sight of Prussian Upper Silesia. It was not at first successful, but toward the end of the century received more encouragement and support from the Russian authorities, and was for a short time the biggest single center of iron production in the Tsarist Empire.

But Russian policy was erratic and the interests of the industrialists were always subordinated to those of the military strategists. In Austrian Poland, or Galicia, as it was usually called, industrial development, other than the mining of salt and extraction of petroleum and small quantities of other minerals, was discouraged. The industrial focus of the Hapsburg Empire lay in Bohemia and Moravia, and competition from Polish Galicia was not favored.

## THE FIRST REPUBLIC

Thus, the Polish Republic in 1918 inherited the uneven industrial developments of Russian and Austrian Poland and a fragment only of that of Prussian. Its task was to knit these fragments together. The continuing partition of the Upper Silesian coal field and of its accompanying metallurgical industries made this difficult.[7] Indeed, further expansion of industry in Polish Upper Silesia did not recommend itself, chiefly owing to the political difficulties and dangers inherent in the divided character of the area.

Instead, the Polish government planned a new industrial region—the Central Industrial District (*Centralne Okręg Przemysłowy*)—around the confluence of the Wisła and the San.[8] Emphasis was placed on metallurgy, engineering and munitions industries, and among the achievements of the plan were the establishment of the Stalowa Wola iron and steel plant, extensions to the works at Starachowice, and the building of some engineering, chemicals, and ceramic factories. But the plan, initiated in 1936 and inter-

[4] Jan Pazdur: "Przemysł metalowy zaglebia staropolskiego w I połowie XIX w," *Kwartalnik Historii Kultury Materialnej*, Vol. 2, 1954, pp. 24–44; *idem.*, "Górnictwo i hutnictwo zaglebia staropolskiego w połowie XIX w (1846–1894)," *Kwartalnik Historyczny*, Vol. 63, 1956, pp. 200–220.

[5] L. Straszewicz: "Kompleks przemysłowy Łódzi, "*Przegląd Geograficzny*, Vol. 29, 1957, pp. 741–777.

[6] A. Werwicki: *Białostocki Okręg Włókienniczego do 1945 Roku*, Prace Geograficzne, Vol. 10, Warszawa, 1957.

[7] Norman J. G. Pounds: "Planning in the Upper Silesian Industrial Region," *Journ. of Central European Affairs*, Vol. 18, 1958–1959, pp. 409–422.

[8] Ferdynand Zweig: *Poland between Two Wars*, London, 1944, pp. 77–80.

rupted three years later by the German and Russian invasions, was too short-lived to have made a deep impression on the industrial structure of the country.

The years between the two world wars do not stand out as a period of economic growth. Despite the initiation of the planned Central Industrial District, the creation of the port of Gdynia and of its dockside industries, and the increased export of coal, there was only a very small growth of the industrial output of Polish Upper Silesia. Industrial employment in 1937–1939 was only 25 per cent above the level of 1907–1910 for the same area.[9]

## PLANNED DEVELOPMENT

The wartime and postwar years have seen great changes in the structure of Polish industry. The destruction of the war period was to a very slight degree offset by the construction of new war industries by the Germans. Not all of these have been of service to the Polish state, but the large chemical combines of Kędzierzyn and Oświęcim originated in plants built by the Germans during the war. On the other hand, existing plant and mines were operated intensively, without proper regard to maintenance and replacement. Wartime destruction was particularly severe in Warszawa and in the north and west. In the Recovered Territories very few cities escaped major damage in the campaigns of 1944–1945, and the cities of Gdańsk, Szczecin, and Wrocław were largely destroyed. On the other hand, damage was slight in Łódz and Kraków, and was not extensive in the industrial region of Upper Silesia. In the Recovered Territories, also, there was extensive, though little publicized, dismantling of industrial equipment by the Russians. Equipment, especially that in the chemicals, metallurgical, engineering, and cement industries, was removed to the Soviet Union, thus reducing the employment needs of the area by an estimated 100,000 persons.

Industries were nationalized and all significant developments have since been promoted by the state. Private enterprise, though severely discouraged under the 6-year plan, never disappeared completely from Polish industry and since 1956 has been increasing. In 1956 there were 4490 private enterprises classified as industrial, with a total labor force of 11,048. Their number has since increased, but does not now appear to be growing.

The westward movement of Poland's boundary to the line of the Sudety, the Nysa, and the lower Odra has greatly increased the country's developed industry and also its potential for further growth. Poland acquired the numerous small industrial centers along the foothills of the Sudety and the important though severely damaged factories of Gdańsk, Szczecin, and Wrocław, as well as of numerous small cities. Coal resources were increased by two-thirds with the acquisition of the Lower Silesian field and the German-held sector of the Upper Silesian.[10] The importance of this gain was even greater than this figure suggests, because coking coal forms a high proportion of the output from Lower Silesia and a relatively large fraction of that

[9] J. Kantor and A. Kukliński: "Struktura przestrzenna przemysłu na obszarze Polski w latach 1946–1956," *Inwestycje i Budownictwo*, No. 7, 1958, pp. 5–8.

[10] F. Barciński: "Bogactwa naturalne ziem odzyskanych i ich znaczenie gospodarcze dla Polski," *Przegląd Zachodni*, Vol. 3, 1947, pp. 12–30; J. Kolipiński: "Rola ziem odzyskanych w organizmie gospodarczym Polski," *loc. cit.*, Vol. 2, 1946, pp. 511–521; S. Leszczycki: "The Geographical Bases of Contemporary Poland," *Journ. of Central European Affairs*, Vol. 6, 1948, pp. 357–373.

TABLE I

TOTAL INVESTMENT, 1950–1957

| | *Total investment in millions of zloty* | *In industry* | | *In transportation* | |
|---|---|---|---|---|---|
| | | *Zloty* | *Percentage* | *Zloty* | *Percentage* |
| 1950 | 19,610 | 8,277 | 42.2 | 3,061 | 15.6 |
| 1951 | 23,678 | 9,840 | 41.6 | 3,456 | 14.6 |
| 1952 | 27,623 | 14,064 | 50.9 | 3,477 | 12.6 |
| 1953 | 32,603 | 16,026 | 49.2 | 3,787 | 11.6 |
| 1954 | 34,192 | 16,275 | 47.6 | 3,701 | 10.8 |
| 1955 | 34,393 | 15,140 | 44.0 | 3,523 | 10.3 |
| 1956 | 51,686 | 21,195 | 41.0 | 4,565 | 8.8 |
| 1957 | 54,099 | 21,914 | 40.5 | 5,011 | 9.3 |

(Source: *Rocznik Statystyczny, 1956*, Warszawa, 1956, p. 202; *Maly Rocznik Statystyczny, 1958*, Warszawa, 1958, p. 61.)

from the newly acquired area of Upper Silesia. Extensive though little developed brown coal fields in *woj.* Zielona Góra and Wrocław were added to Polish resources, together with small reserves of copper, lead, and zinc ores. Perhaps more important than the actual increase in total Polish coal reserves is the unified control which has been established over the whole Upper Silesian coal basin, permitting the more effective use of its resources.

For a century and a half the Odra has seemed the natural outlet for the coal and industrial products of Upper Silesia. The industrial region was linked by canal with the river at Kozle in the early years of the nineteenth century, but the river remained for the greater part unimproved. Proposals for the improvement of navigation were strongly opposed by West German industrial interests, jealous for their markets in Central Germany. The waterways remained little used and the industrial potential of Upper Silesia unrealized.

Boundary changes of 1945 put the Odra, together with the Gliwicki Canal, recently cut to replace the now useless Kłodnicki Canal, under Polish control. A later boundary change gave Poland also the city and port of Szczecin. The full utilization of these waterways for the transport of coal, iron ore, steel goods, and other industrial products and raw materials now awaits only the completion of works on the middle section of the river.

The first post-war Polish plan ran for the period 1947 to 1949. Its object was broadly to restore the country's productive capacity to the level of 1939. In this it was largely successful. The succeeding 6-year plan (1949–1955) and the current 5-year plan have as their objective the extension of the productive capacity of the country. The total investment during these years not only increased absolutely but also in relation to national income.

TABLE II

INCREASE IN INDUSTRIAL PRODUCTION, 1937–1938 TO 1957

| | *Iron ore** | *Coal†* | *Pig iron** | *Steel** | *Electric power‡* |
|---|---|---|---|---|---|
| 1937–1938 | 850 | 67.5 | 1,035 | 1,979 | 3,800 |
| 1949 | 684.4 | 74.1 | 1,391.1 | 2,304 | 8,300 |
| 1953 | 1,308.7 | 88.7 | 2,358.9 | 3,603.7 | 13,679.4 |
| 1954 | 1,574.5 | 91.6 | 2,662.8 | 3,949.2 | 15,468.9 |
| 1955 | 1,856.0 | 94.5 | 3,112.1 | 4,426.4 | 17,751 |
| 1956 | 1,973 | 95.1 | 3,506 | 5,014 | 19,495 |
| 1957 | 1,994 | 94.1 | 3,682 | 5,304 | 21,155 |

*in thousands of metric tons.
†in millions of metric tons.
‡in millions of kilowatt hours.
(Source: *Rocznik Statystyczny*, 1956, 1957, 1958; A. Kukliński: "Uprzemysłowienie Polski w perspektywie historycznej," *Przegląd polski i obcy*, 1957, Number 4–5, p. 11.)

TABLE III

POPULATION IN INDUSTRY

| | *Total population, in thousands* | *Employed in industry thousands* | *Percentage* |
|---|---|---|---|
| 1907–1910 | 26,600 | 1,200 | 4.5 |
| 1937–1939 | 32,000 | 1,500 | 4.7 |
| 1946 | 23,900 | 1,202 | 5.0 |
| 1949 | 24,600 | 1,670 | 6.8 |
| 1953 | 26,511 | 2,466.5 | 9.3 |
| 1954 | 27,012 | 2,575.5 | 9.6 |
| 1955 | 27,550 | 2,690.6 | 9.8 |
| 1956 | 28,076 | 2,802.7 | 10.0 |
| 1957 | 28,535 | 2,897 | 10.2 |

(*Rocznik Statystyczny*, 1955, 1956, 1957.)

Manufacturing industry, which included mining, absorbed slightly less than a half of the total investment, and transport over 12 per cent[11] (Table I). It is apparent from these figures that investment in agriculture, building, and social services was relatively small.

Within the industrial sector, investment was strongly in favor of the heavy industries, especially coal mining, iron and steel, chemicals, and electric power. The sharp increase in productivity in these fields is indicative of the heavy investment in them (Table II). There has been a commensurate increase in employment in industry[12] (Table III). This increase in the percentage of the total population employed in mining, industry, and handicrafts was paralleled by a proportionate increase in employment in trade, transportation, and building. Poland has thus ceased to be a predominantly rural and agricultural country.

*Statistical Data*

Since 1955 the progress of industrial growth has been made public in a statistical yearbook. This published data, however, contained little information on the location of the new industrial investment beyond a tabulation of total investment by *województwa* or provinces (Fig. 1). This data is represented cartographically in Figure 2. The biggest total investment and by far the largest investment in industry is seen to be in the city of Warszawa and in the southern *województwa* of Kraków and Katowice.[13] The implications of this are discussed later.

In 1958 the Statistical Office of the Polish Peoples' Republic prepared an industrial census sufficiently full and detailed to make possible an appraisal of the new industrial geography of Poland.[14] Data is given for employment, but unfortunately not for output. Industries are grouped into categories as follows: (1) generation of electric power; (2) fuel industries (including mining) and industries based on fuel (coking, refining, etc.); (3) iron and steel (including iron ore mining); (4) non-ferrous metals, mining and smelting; (5) machinery and metal industries; (6) chemical industries; (7) rubber industry; (8) industries based on mineral products (other than groups 1 to 4); (9) building materials industries; (10) glass, china and porcelain; (11) timber and woodworking industries; (12) paper industry; (13) textile industry; (14) clothing industries; (15) leather, footwear, furs, and skins; (16) fats, soap, and cosmetics; (17) food industries, including brewing, and distilling; (18) salt working; (19) printing; and (20) other branches of industry.

These 20 categories are broken down into no less than 148 branches and most of these are subdivided. For each the number of establishments and the total employment is given by *województwa* and also for the socialized and the

[11] "The Polish Economy since 1950," *Econ. Bull. for Europe*, Vol. 9, No. 3, 1957, pp. 21–48.

[12] J. Kantor and A. Kukliński: *op. cit.*

[13] *Rocznik Statystyczny*, 1956, p. 203.

[14] *Statystyka Przemysłu: statystyka zakładów przemysłowych i rzemieślniczych 1956*, mimeographed, Główny Urząd Statystyczny, Warszawa, 1958. Some of this data had previously been published in the *Biuletyn Statystyczny*.

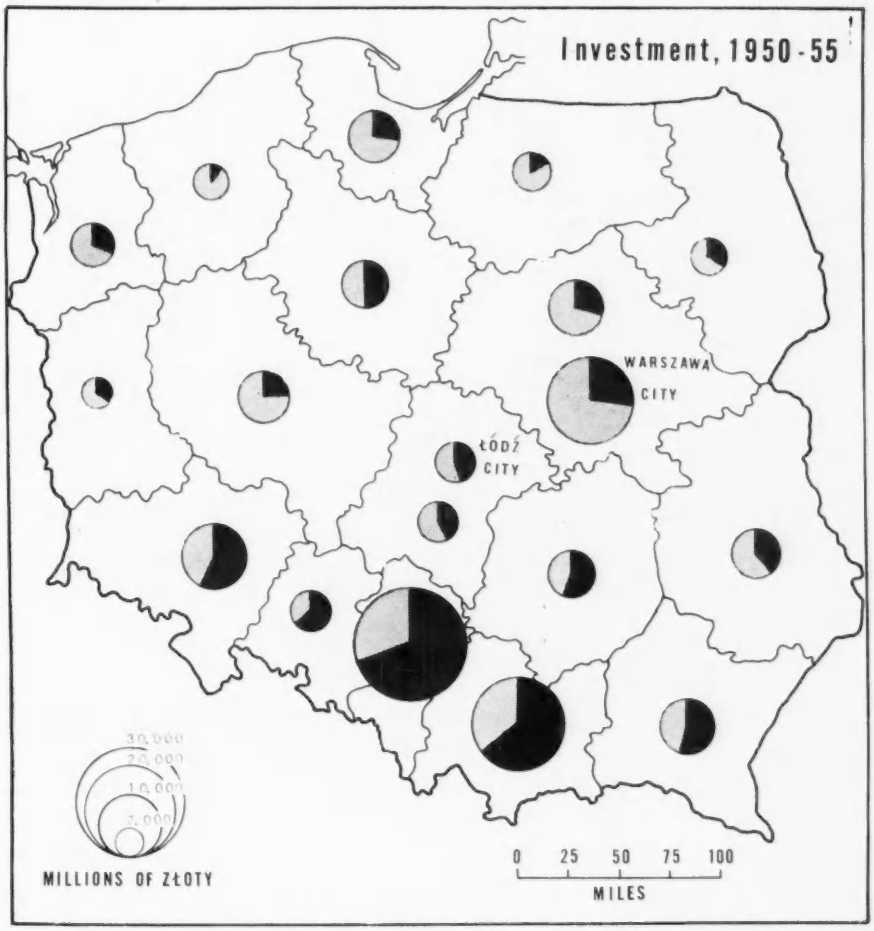


FIG. 2. The volume of capital investment in Poland, 1950–1955, by *województwa*. The proportion invested in industry is shown black (Source: *Rocznik Statystyczny*, 1956, p. 203).

private sectors of industry. The establishments of each of the major industrial groups are classified by size for each *województwo*. The number of establishments and total employed for both socialized and private sectors is tabulated for each *powiat*, the smallest administrative unit. Unfortunately, although this latter tabulation distinguishes between industry (*przemysl*) and handicrafts (*rzemioslo*) it does not do so between the various branches of industry. Nevertheless, the tables give a wealth of material for geographical analysis.

## DISTRIBUTION OF INDUSTRIAL POPULATION

The tables of industrial employment have been used in preparing Figure 3, which shows the percentage of total population in each *powiat* engaged in industry. Employment in handicrafts

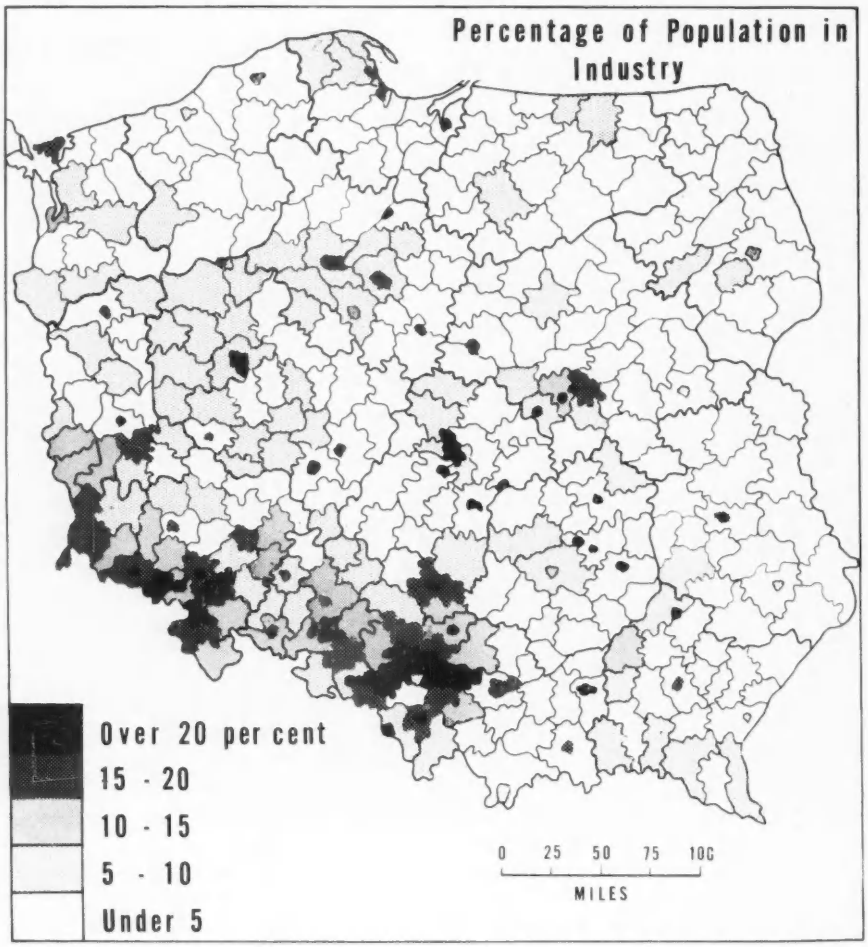


FIG. 3. Percentage of total population employed in industry. (Source: *Statystyka Przemyslu*, Warszawa, 1958.)

has not been included. There is a heavy concentration in Lower and Upper Silesia and in the western parts of *woj.* Kraków. The areas surrounding the cities of Warszawa, Łódz, Bydgoszcz, and Poznań also show a fairly high percentage of industrially employed persons. It is notable that a line from Szczecin, through Bydgoszcz, Warszawa, and Lublin to Rzeszów, separates a relatively industrialized west and southwest from an almost non-industrialized northeast and east. This line does not conform with any earlier political division. It might be said that the more developed areas were the southern part of former German-held Poland and that part of Russian-held Poland which had a standard gauge railroad. If handicrafts had been included, the north and east would have made a somewhat better showing.

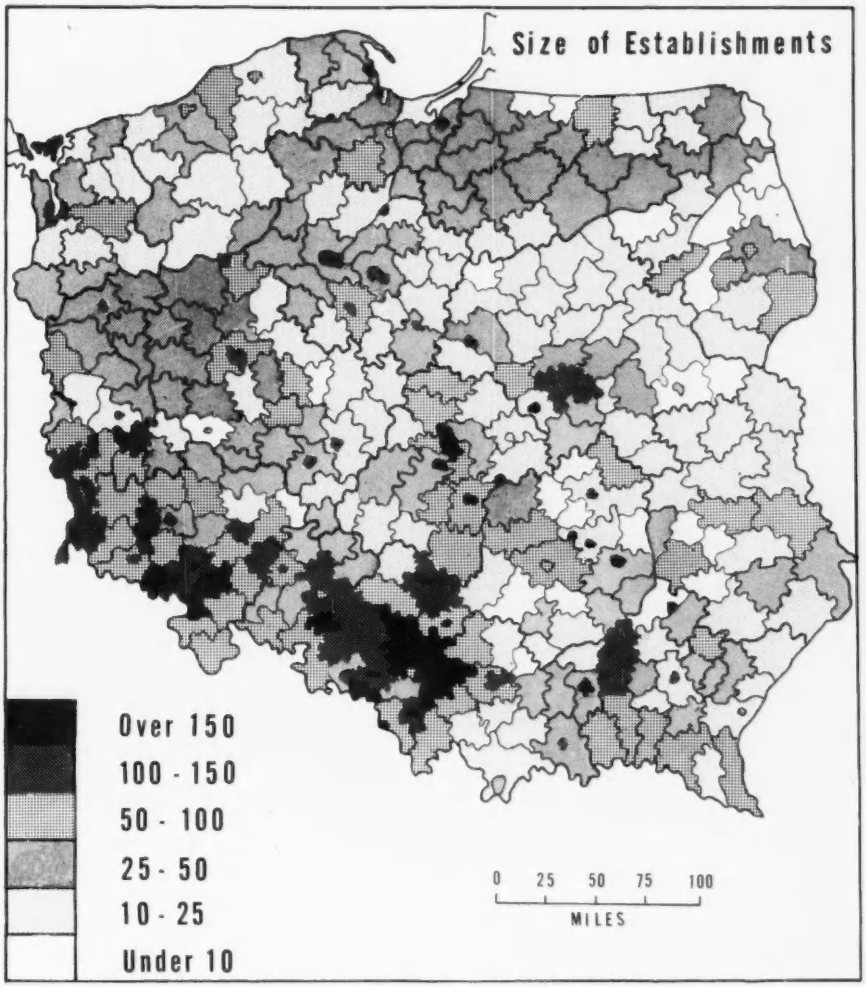


FIG. 4. Average number of employees in industrial establishments, by *powiaty*. (Source: *Statystyka Przemysłu*, Warszawa, 1958.)

Figure 4, based upon the same tabulation, shows the average size of industrial undertakings. The totals for handicrafts were excluded. Contrasts are less marked than in Figure 3. Relatively large factories predominate in Silesia and parts of Kraków and locally elsewhere, but a comparison of Figures 3 and 4 shows that in the Sudety, where the textile industry in particular is well developed (see below), factory units are small. On the other hand, establishments in the lightly industrialized north and east are relatively large. This is due in large degree to the wartime destruction in these areas. All types of plant suffered severe damage, and hitherto

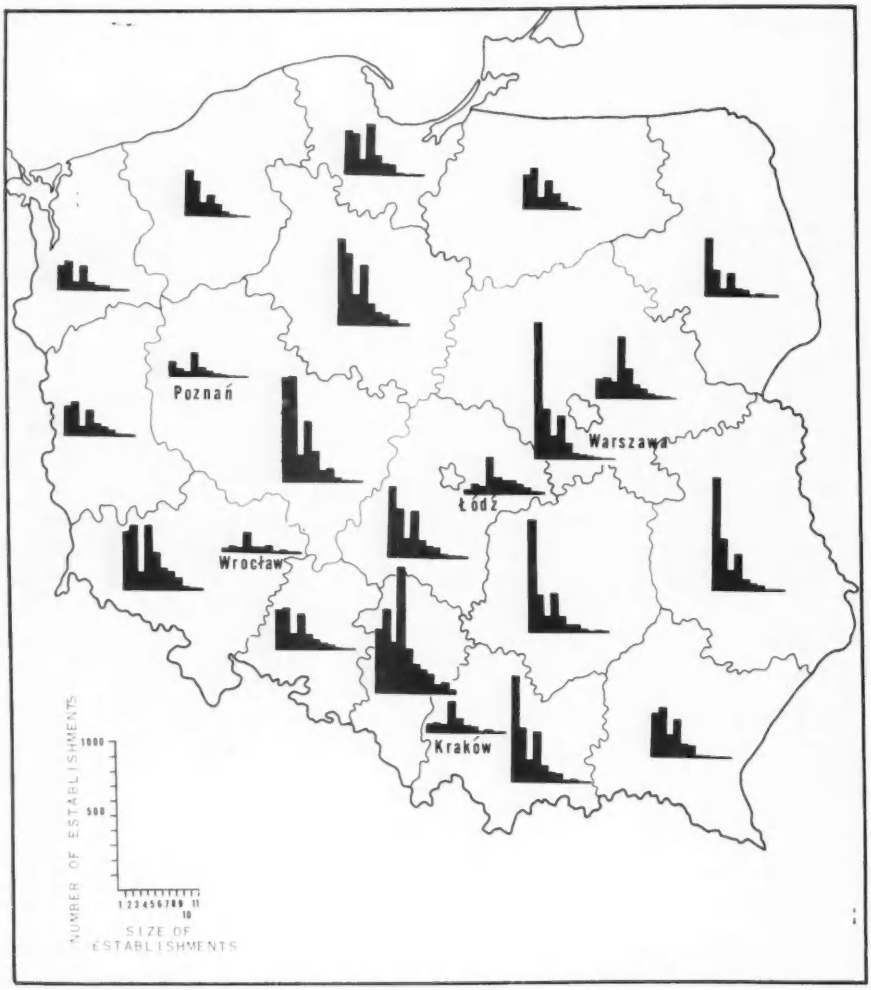


FIG. 5. Size of industrial establishments, by *województwa*. For key to numbers denoting size see graphs, Figures 13 to 15. (Source: *Statystyka Przemysłu*, Warszawa, 1958.)

only the larger have been rebuilt and re-equipped.[15]

Figure 5 shows the number and size of industrial undertakings by *województwa*. For the country as a whole there is a two-phase distribution of establishments. Most numerous are those employing up to four persons; next, those with 16 to 50. The first are, in the main, family businesses; the latter are lightly capitalized undertakings which may be taken as typical of the country as a whole (Table IV). The 490 factories and mines with employment totals of over 1000 employees each clearly dominate the industrial

[15] *Gospodarka Planowa*, Vol. 13, 1958, May, pp. 28–32; *Życie Gospodarcze*, Vol. 13, November 30, 1958.

TABLE IV

SIZE OF INDUSTRIAL ESTABLISHMENTS

| *Size of establishment* | *Number of establishments* | *Employment* |
|---|---|---|
| Up to 4 employees | 8,284 | 17,004 |
| 5 " 10 " | 6,219 | 46,300 |
| 11 " 15 " | 2,530 | 32,418 |
| 16 " 50 " | 6,389 | 187,487 |
| 51 " 100 " | 2,633 | 186,342 |
| 101 " 200 " | 1,507 | 211,130 |
| 201 " 500 " | 1,203 | 375,489 |
| 501 " 1,000 " | 538 | 374,138 |
| 1,001 " 2,000 " | 268 | 370,098 |
| 2,001 " 5,000 " | 173 | 535,110 |
| Over 5,000 " | 49 | 339,198 |
| | 29,793 | 2,674,714 |

picture, with nearly half the total employees. Almost a third of these enterprises are engaged in the engineering industries and 87 and 85 respectively in the textile industry and coal mining. The large units are overwhelmingly located in the south and southwest, where *woj.* Katowice alone has 164, and in Łódz and Warszawa.

Figure 5, which shows the distribution of establishments by both size and province, demonstrates the two-phase nature of the industrial structure. This map suggests a division of the country. An industrially developed area covering the southwest, and extending to include Łódz and Warszawa, is characterized by a relatively large number of units of intermediate size. By contrast the center and east are marked by a large number of small and very small units. One would expect the northern *województwa* to belong to this group; the restricted number of small units there, compared with, for example, *woj.* Kielce or Lublin, is due to wartime destruction.

## DISTRIBUTION OF INDUSTRY, 1956

It has not been practicable to prepare maps of each of the 20 categories of industry enumerated in the census. Several have been grouped together, for instance, chemicals and rubber, timber and paper. Figure 6 shows the distribution of employees in eight categories to which the 20 listed above have, for the convenience of presentation here, been reduced. The heavy predominance of *woj.* Katowice, which contains the Upper Silesian industrial complex, is apparent. After Katowice comes the industrial belt reaching from *woj.* Kraków to *woj.* Wrocław; then central Poland, with *woj.* Łódz, Poznań, Bydgoszcz, Kielce, and the city of Warszawa. Elsewhere, not only is industrial development slight but it is heavily biased in favor of woodworking, food, and clothing industries: in short, the consumers' goods industries.

### *Extractive Industries*

Figure 7 illustrates employment in the fuel and metalliferrous industries. Its pattern has not greatly changed in recent years, but it has become more intense. The production of bituminous coal is now about 15 per cent higher than the output from the same area before 1939. To this must be added the current expansion of brown coal mining, especially near Konin, *woj.* Poznań. This has now expanded considerably beyond the level indicated by employment figures for 1956, and is to become the basis of large-scale thermal electric energy generation, which will in turn assist industrial development in this region of Central Poland.[16]

[16] K. Bielski: "Węgiel brunatny—podstawa polskiej energetyki," *Wiadomości Górnicze*, Vol. 9, 1958, pp. 356–358; A. Strzeminski: "Nowy program perspektywicznego rozwoju polskiego przemysłu węgla brunatnego," *Gospodarka Planowa*, Vol. 13, January, 1958, pp. 32–37; W. Gorski: "Perspektywy regionu konińskiego," *loc. cit.*, Vol. 13, August, 1958, pp. 37–43.

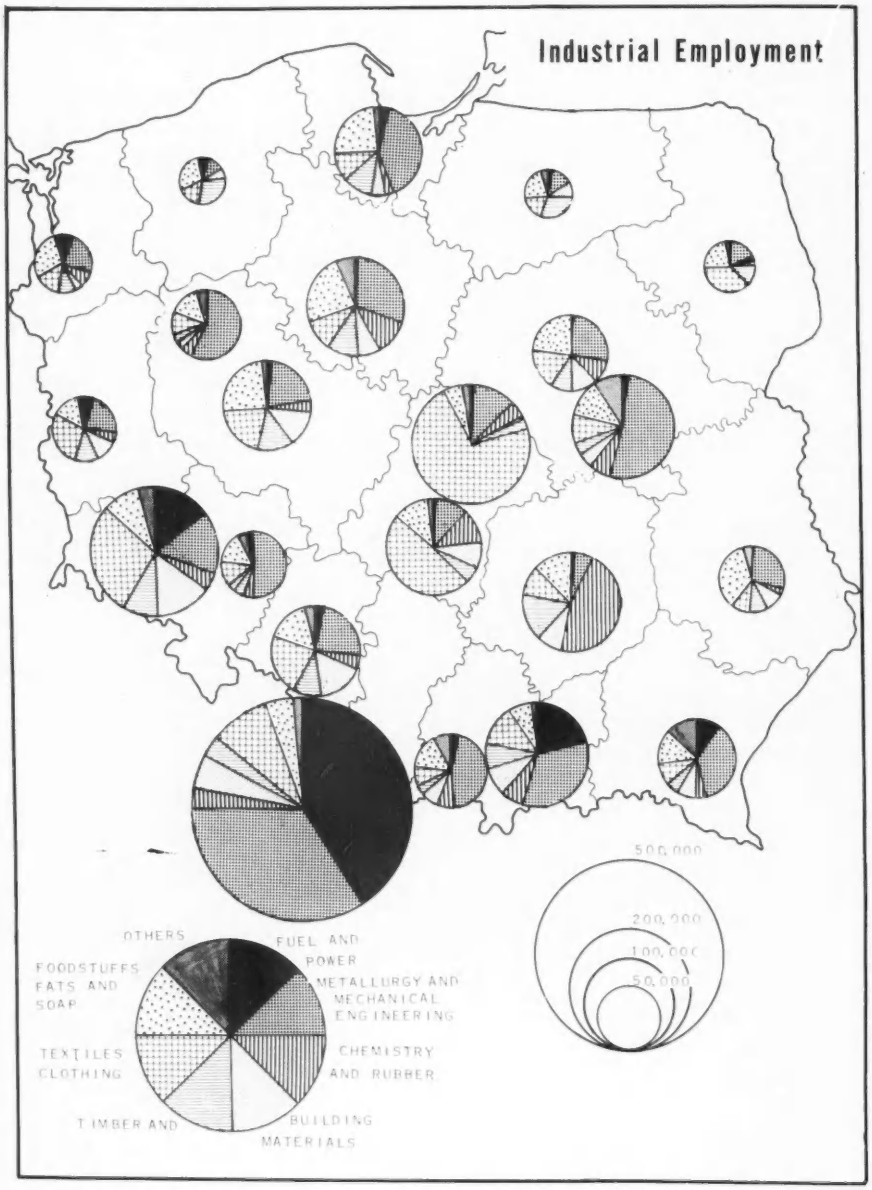


FIG. 6. Employment in industry, by *województwa*. The 20 categories used in the census have here been reduced to eight. (Source: *Statystyka Przemysłu*, Warszawa, 1958.)

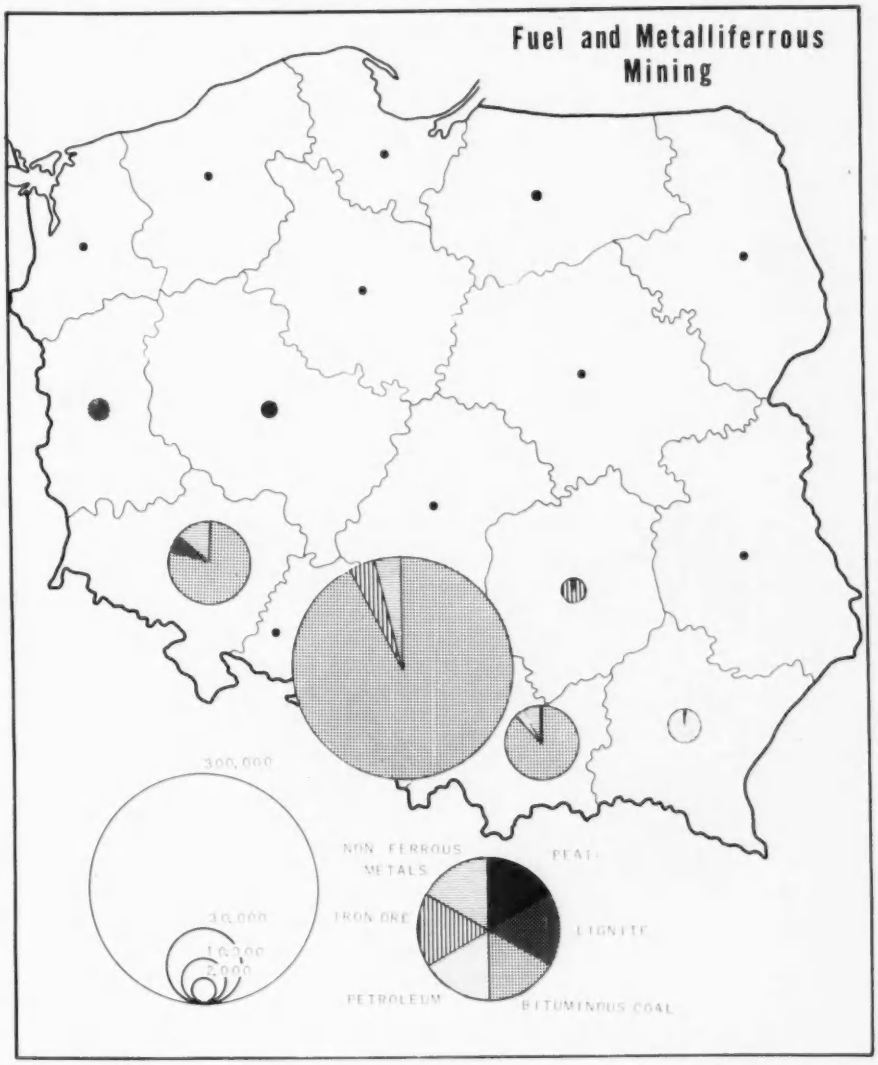


FIG. 7. Employment in the mining industries. (Source: *Statystyka Przemyslu*, Warszawa, 1958.)

Peat or turf is obtained very widely. Its importance is small, but the abundance of peat deposits, especially in the poorly industrialized north, has prompted suggestions that it might be more extensively used for generating power.[17]

The distribution of the remaining extractive industries may be seen in Figures 7 and 8. Iron mining is shown only in Katowice, where it represents the mines in the Jurassic deposits near

[17] F. Szczepanski: "Złóża torfu w Polsce," *Przegląd Geograficzny*, Vol. 29, 1957, pp. 779–784.

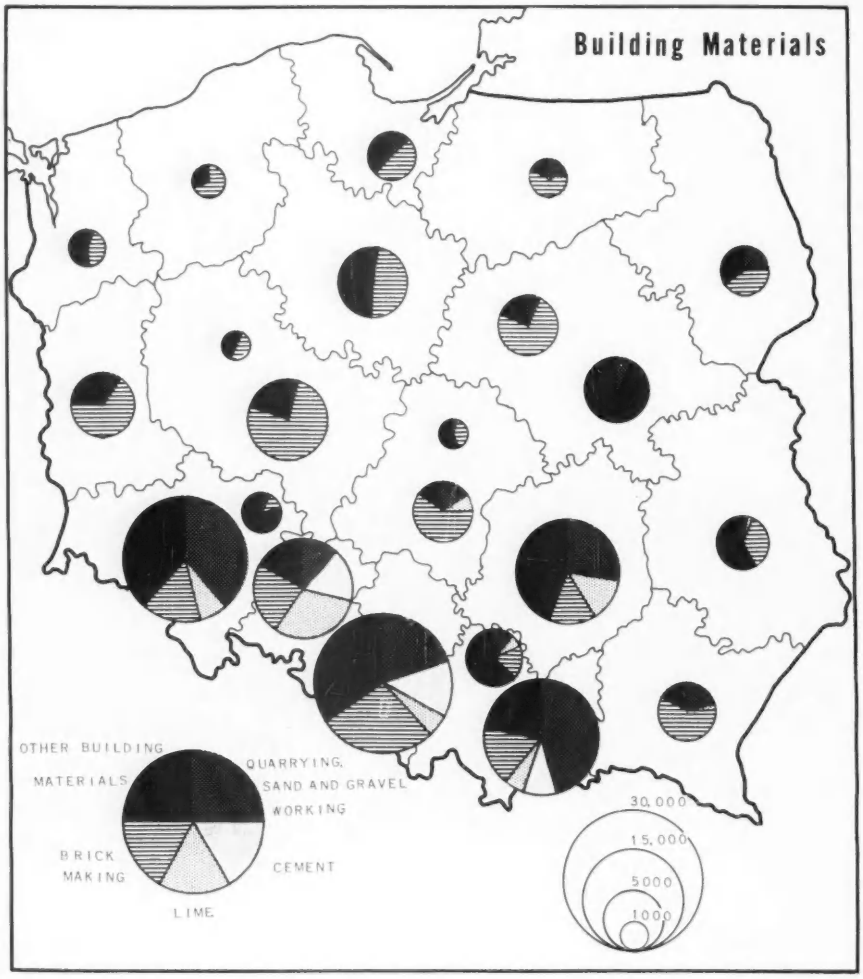


FIG. 8. Employment in the production and preparation of building materials. The category "cement" includes only the manufacture of crude cement. The preparation of concrete building materials is included in "other building materials." (Source: *Statystyka Przemysłu*, Warszawa, 1958.)

Częstochowa, and in Kielce. Nonferrous mining in *woj.* Katowice and Kraków is mainly of lead and zinc, and in *woj.* Wrocław, of copper. Quarrying, mainly of building stone and aggregate, is represented in every *województwo* except Koszalin. Lime and cement[18] are important in Opole; sulphur[19] is obtained in *woj.* Kielce and Wrocław, and salt from the ancient salt mines of Wieliczka and Bochnia in *woj.* Kraków.

[18] R. Markiewicz: "Przemysł cementowy przez pryzmat wskaźników techniczo-ekonomicznych," *Gospodarka Planowa*, Vol. 13, December, 1958, pp. 11–14.

[19] J. Kostrowicki: "Główne problemy zagospodarowania przysłego obszaru eksploatacji i przetworstwa siarki w Polsce," *Gospodarka Planowa*, Vol. 13, November, 1958, pp. 6–12.

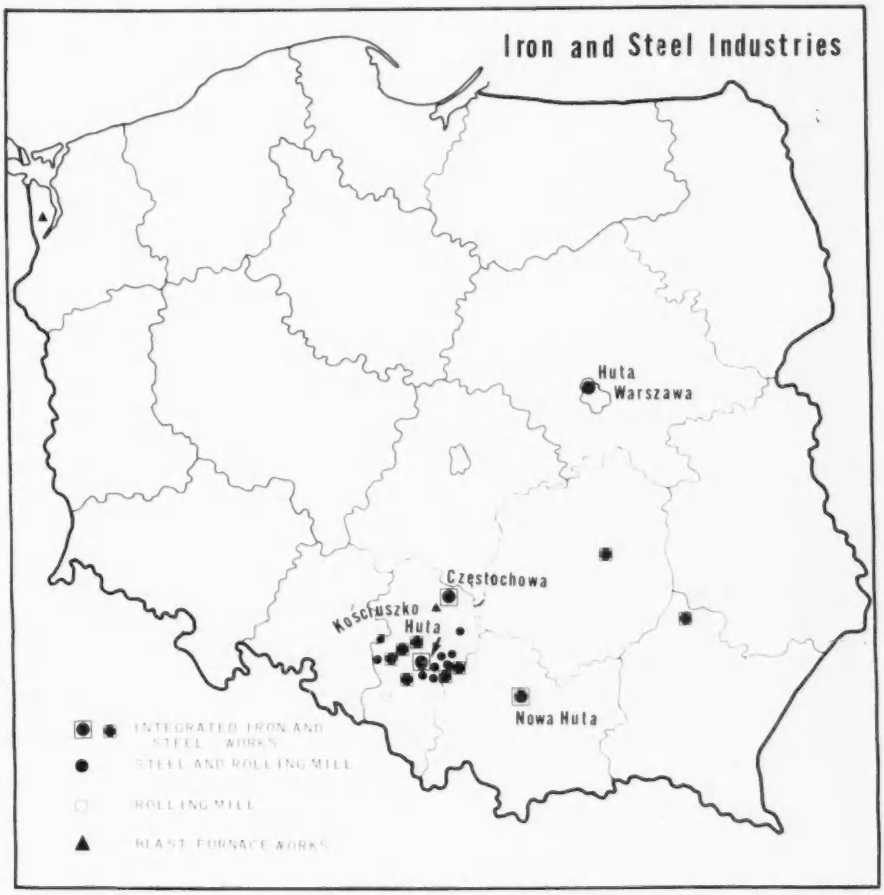


FIG. 9. Location of iron and steel industries in Poland. The larger symbol used for three integrated works indicates a pig-iron capacity of over 500,000 tons.

*Iron and Steel and Other Smelting Industries*

A map has not been prepared to illustrate the distribution of employment in iron and steel and other smelting industries, as it is severely localized. The detailed tables record employment in smelting and steel making only in *woj.* Katowice and Kielce. This is not the case now, however, and was probably incorrect when the figures were collected. Nowa Huta, near Kraków, and the Huta Warszawa were already in production in 1956, and there is also a small blast furnace works at Szczecin. Figure 9 shows the distribution of iron and steel works. Employment in the nonferrous smelting industries is recorded for only three *województwa* (Table V).

The plans call for a large increase in output of iron and steel, which has already expanded more rapidly than almost any other sector of Polish

TABLE V

THE NONFERROUS SMELTING INDUSTRY

| *Województwo* | *Number of smelters* | *Employment* | *Metals smelted* |
|---|---|---|---|
| Wrocław | 4 | 5,544 | copper |
| Katowice | 4 | 9,762 | lead, copper, cadmium, zinc |
| Kraków | 2 | 2,265 | lead, zinc, cadmium |

industry. Great difficulties are foreseen in the supply of ore, and it is expected that by 1965 imports of iron ore will amount to 11 million tons.[20] Most of the present import—5.99 million tons in 1957—is from the Soviet Union, and, though attempts are being made to tap other sources, it is assumed that the proportion of the ore obtained from the U.S.S.R. will increase. Great difficulties are met with both in the inefficiency of the mechanism for handling the imported ore and in the relatively low efficiency of the iron and steel plant itself.[21] Intensive prospecting within Poland has not revealed any significant deposits of good quality ore, though extensive deposits of low-grade have been located.[22]

The incorporation of Silesia into Poland has helped to solve the fuel problem, as most of the coking coal lies in the Lower Silesian field and along the western margin of the Upper Silesian. New mines are being sunk to increase the yield of metallurgical fuel, but complete independence of imported coke and coking coal is not expected.[23]

### *Engineering Industries*

The large and varied group of engineering industries is developed in all except the northern *województwa*, and even here *woj.* Gdańsk forms an exception (Fig. 10). The heavy engineering industries of Warszawa and *woj.* Bydgoszcz and Katowice are conspicuous, as well as the shipbuilding of *woj.* Gdańsk and Szczecin, the car industry of Warsaw, and the road and railroad vehicle industries of Poznań and Katowice.

### *Chemical Industry*

The chemical industry is considerably more localized than the engineering industry. The production of heavy chemicals and fertilizers is closely associated with the coal field; that of lighter chemicals and pharmaceutical goods is more widely distributed. The latter shows a concentration in Warszawa. The processing of crude chemicals, such as sulphur and anhydrite, is being expanded in southern and southwestern Poland. At Kędzierzyn in Upper Silesia is the most ambitious project in the field.[24]

[20] J. Gwiazdziński: "O tempie wzrostu produkcji stali," *Zycie Gospodarcze*, Vol. 14, 1959, February, pp. 1–2; K. Andrysik: "Perspektywy zaopatrzenia hutnictwa polskiego w rudy żelaza," *Gospodarka Planowa*, Vol. 13, December, 1958, pp. 44–47; T. Rzebik: "Import rud żelaza z ZSRR," *Wiadomości Hutnicze*, Vol. 14, 1958, pp. 237–241.

[21] J. Gwiazdziński: "Przyczyny niskiej wydajnosci pracy w polskim hutnictwie żelaza," *Gospodarka Planowa*, Vol. 13, 1958, December, pp. 5–11.

[22] J. Znosko: "Osady i obszary perspektywiczne do poszukiwań złóż rud żelaza na Nizu Polskim," *Kwartalnik Geologniczny*, Vol. 1, 1957, pp. 303–328; R. Osika: "Wystepowanie i perspektywy poszukiwawcze złóż rud żelaza w Polsce," *Z Badań Złóz Kruszów*, Instytut Geologiczny, Biuletyn 126, Warszawa, 1958, pp. 9–55.

[23] J. Kuchciński: "Geologiczne zasoby wegla Górnosląskiego Zagłebia Weglowego na tle mapy wegloności," *Kwartalnik Geologiczny*, Vol. 2, 1958, pp. 553–564; A. Pieńkowski: "Czy Polska musi importować wegiel koksujacy," *Gospodarka Planowa*, Vol. 13, 1958, June, pp. 53–56.

[24] "The Importance of the Chemical Industry in the Western Territories," *Zachodnia Agencja Prasowa*, November, 1958, pp. 3–8; "Chemical Industry in the Polish Western Territories," *loc. cit.*, pp. 9–18; S. Frankel and T. Jaworski: "Kedzierzyn i ambitne plany chemii," *Zycie Gospodarcze*, Vol. 12, February 22, 1957.

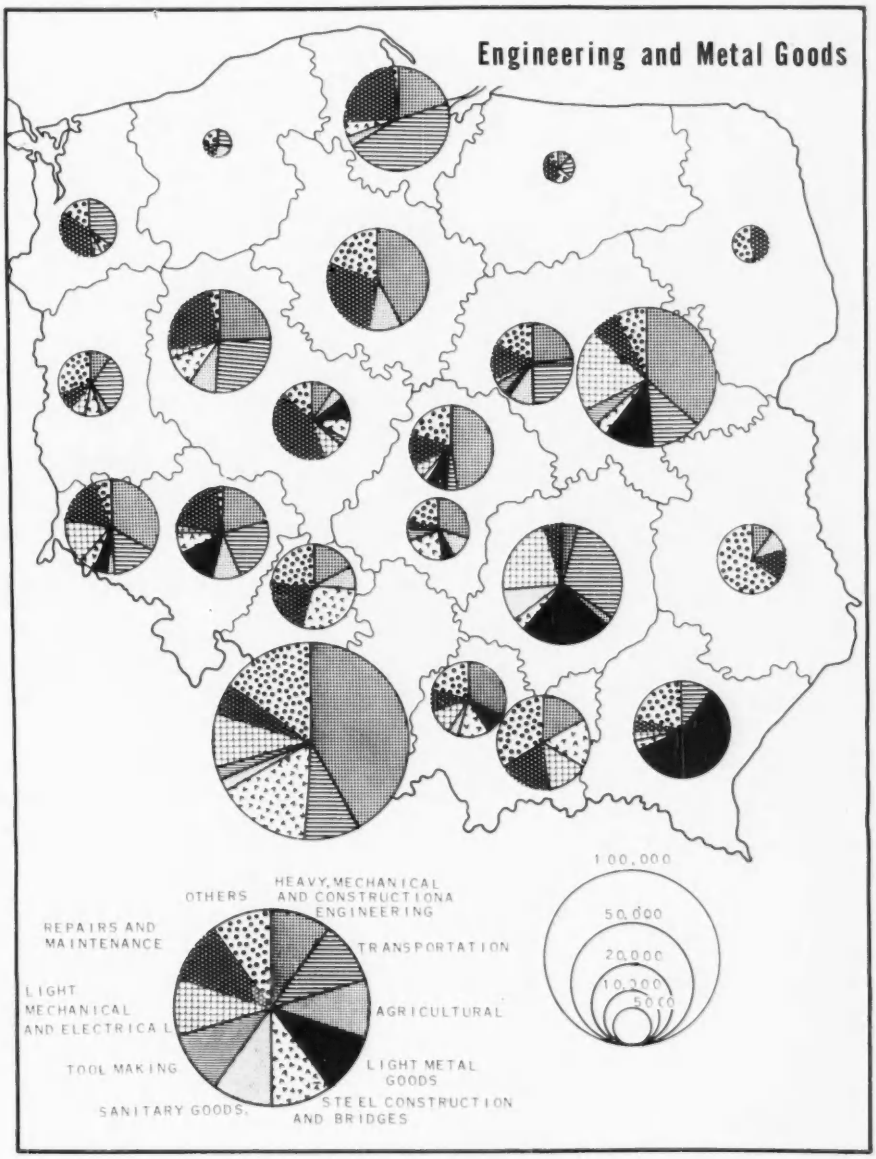


FIG. 10. Employment in engineering and metal goods industries. (Source: *Statystyka Przemyslu*, Warszawa, 1958.)

*Textile Industry*

The city of Łódz dominates the textile industry (Fig. 12), and, if one adds the cities of Zgierz and Pabianice which adjoin it closely, the whole complex has about half of the textile

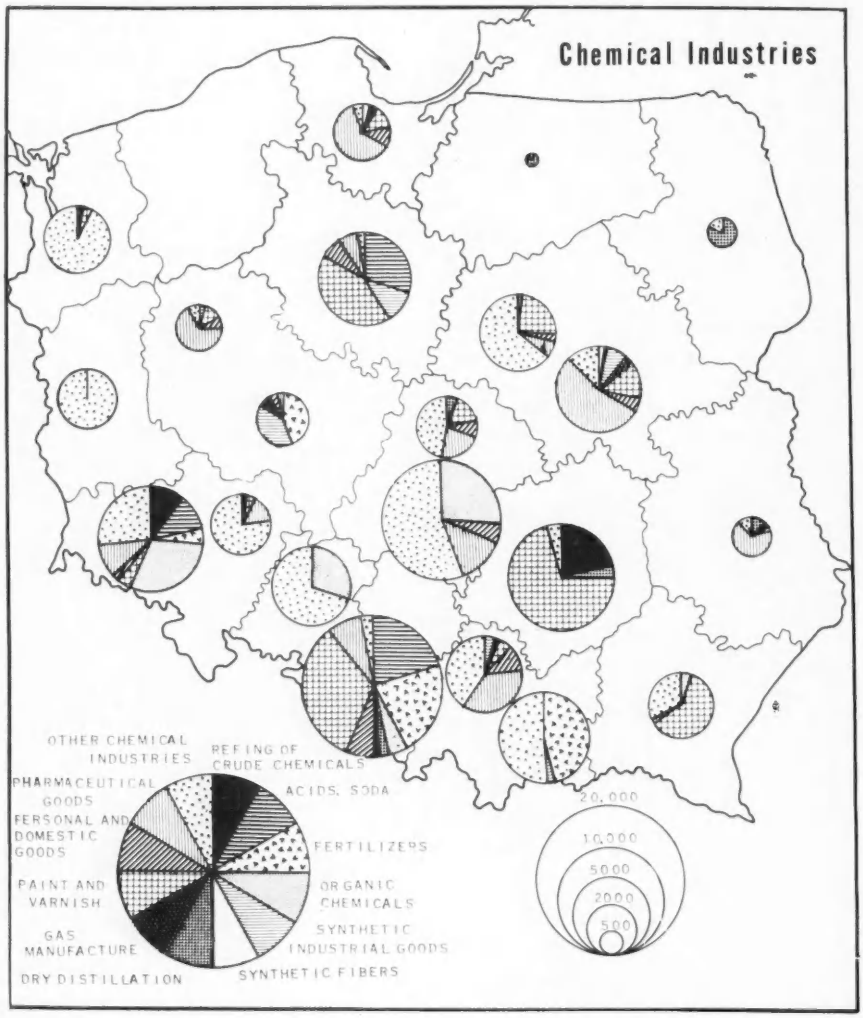


FIG. 11. Employment in the chemical industries. (Source: *Statystyka Przemyslu*, Warszawa, 1958.)

workers of Poland. This district of Łódz has no conspicuous natural advantage; merely the historical accident that it lay just within the boundaries of the Tsarist empire and recommended itself to a group of German entrepreneurs. The industry has been sustained by its early impetus, but now faces acute difficulties in the supply of water for industrial purposes. The textile industry of Białystok grew to importance when, in 1831, it found itself on the Russian side of the tariff barrier newly raised by the Tsarist government against "Congress" Poland. It suffered extensive damage during both World Wars and on neither occasion did it recover wholly from the setback.

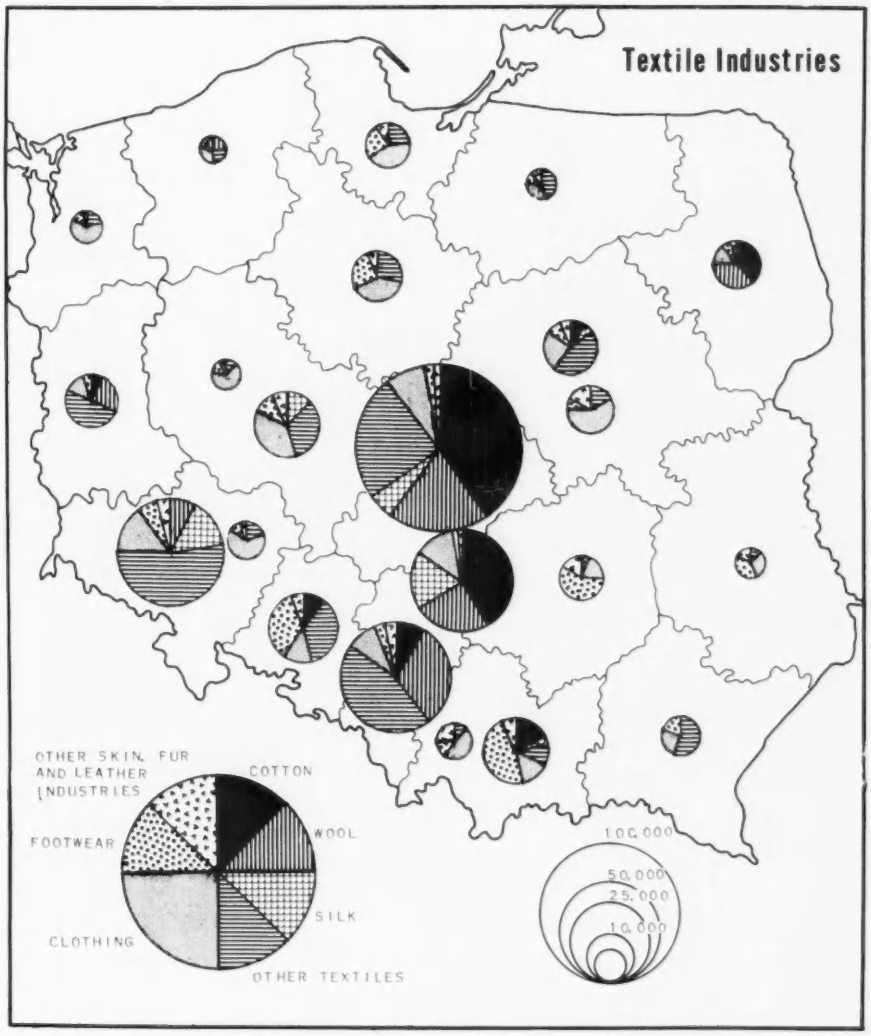


FIG. 12. Employment in the textile industries. The category "other textiles" includes linen, burlap and carpets. The category "footwear" excludes rubber footwear, which is included with the rubber industry in Figure 11. (Source: *Statystyka Przemysłu*, Warszawa, 1958.)

Most of the factories were small and their equipment obsolete.[25] The remaining textile producing region of importance is made up of small settlements in the foothills of the Sudety and Beskidy. Bielsko-Biała (*woj.* Katowice), Swidnica, and Dzierzoniów (*woj.* Wrocław) are among the largest. They still make some use of the water power on which originally they were

[25] A. Werwicki: "Przemiany w uprzemysłowieniu województwa białostockiego," *Przegląd Geograficzny*, Vol. 29, 1957, pp. 561–581; *idem.*, "Białostocki przemysł włókienniczy," *loc. cit.*, Vol. 29, 1957, pp. 583–594.

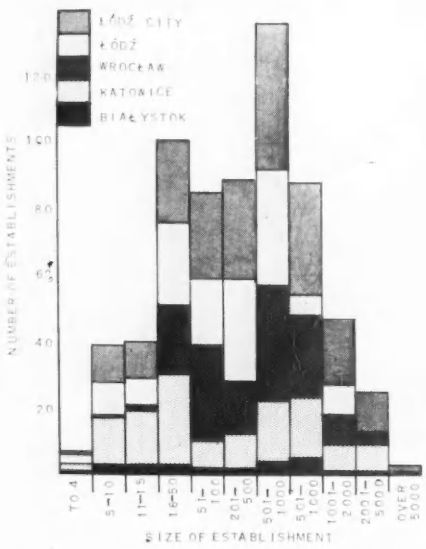


FIG. 13. Number and size of textile-making establishments in the five chief centers of production. (Source: *Statystyka Przemyslu*, Warszawa, 1958.)

based. Wartime damage was slight and most of the factories are still relatively small (Fig. 13). It is evident, however, that the bulk of the employment is in the few large factories. A breakdown of these figures according to the type of textile made is not possible on a regional basis. Figures 14 and 15 show the number and the size of factories producing cotton, woolen, and silk fabrics. As might have been expected, cotton factories are considerably larger than woolen, and it is clear from Figure 13 that the largest of these are in the city of Łódz.

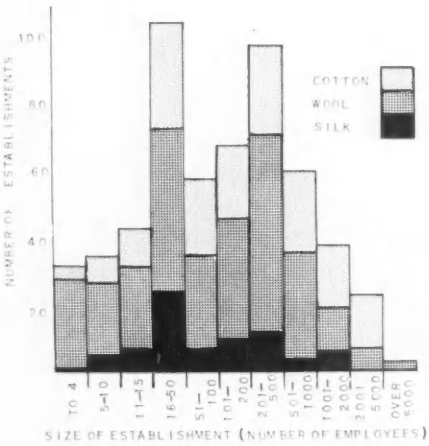


FIG. 14. Number and size of textile-making establishments in the three main branches of the industry. (Source: *Statystyka Przemyslu*, Warszawa, 1958.)

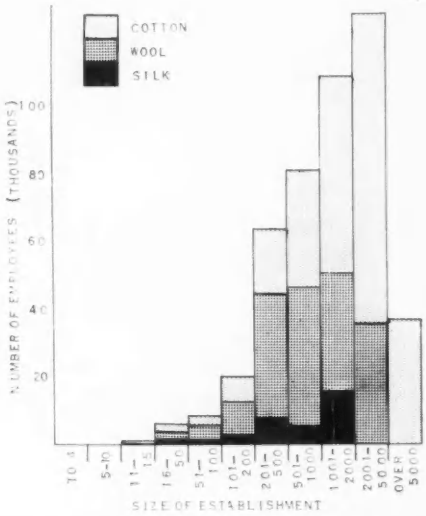


FIG. 15. Number of employees in the three main branches of the textile industry, according to the size of establishment. (Source: *Statystyka Przemyslu*, Warszawa, 1958.)

### *Timber and Paper Industries*

The timber and paper industries (Fig. 16) are more evenly distributed than any others considered so far. Paper making itself is oriented toward the market, with most of the employees located in the southwestern and central *województwa*. Poland is a well-wooded country, and over a third of its area is classified as forest. Sawmilling is absent only from the urban areas and is strongly developed in the northern *województwa* where the proportion of

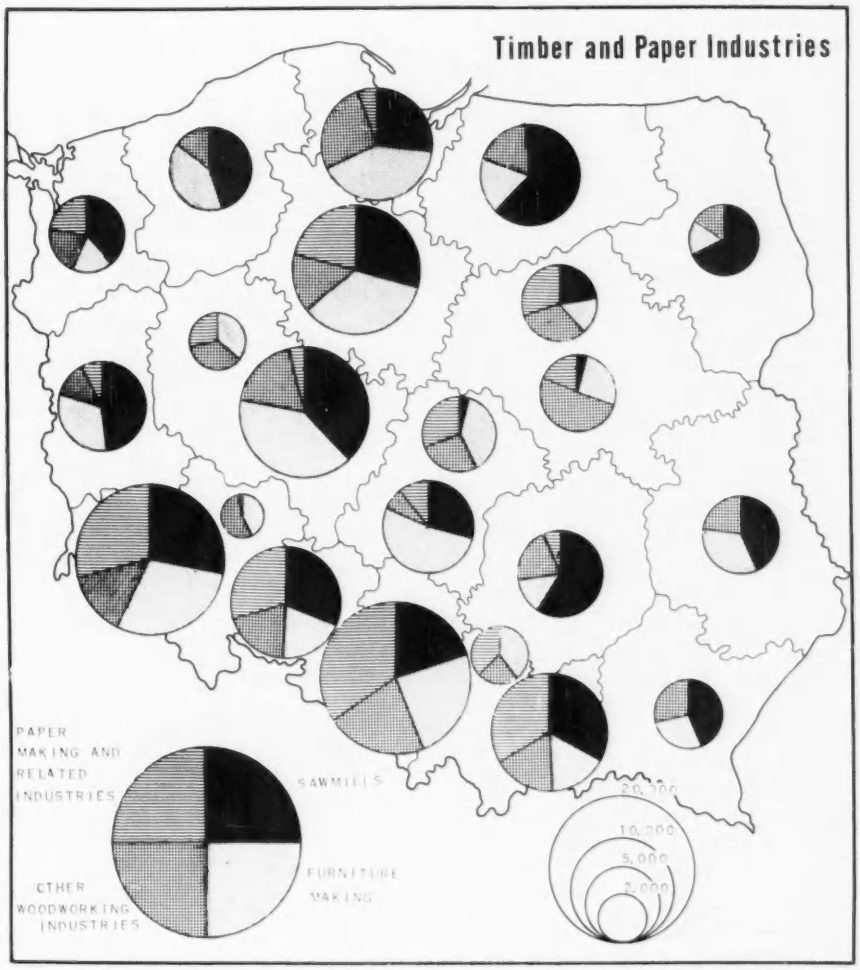


FIG. 16. Employment in the timber and paper-making industries. (Source: *Statystyka Przemysłu*, Warszawa, 1958.)

land under forest is greater and the competition of other industries for labor is less.

*Food Industries*

The food industries constitute a large group. The industries range from animal slaughtering and fishing to flour-milling, distilling, and the preparation of tobacco. They are prominent in the northern and eastern *województwa*, which are, in other respects, not strongly industrialized. The fisheries are important only on the Baltic coast and there chiefly in the port of Gdynia. The meat, milling, and dairy industries are important everywhere. Tobacco is significant only in the southeast and sugar refining only on the better croplands of Silesia,

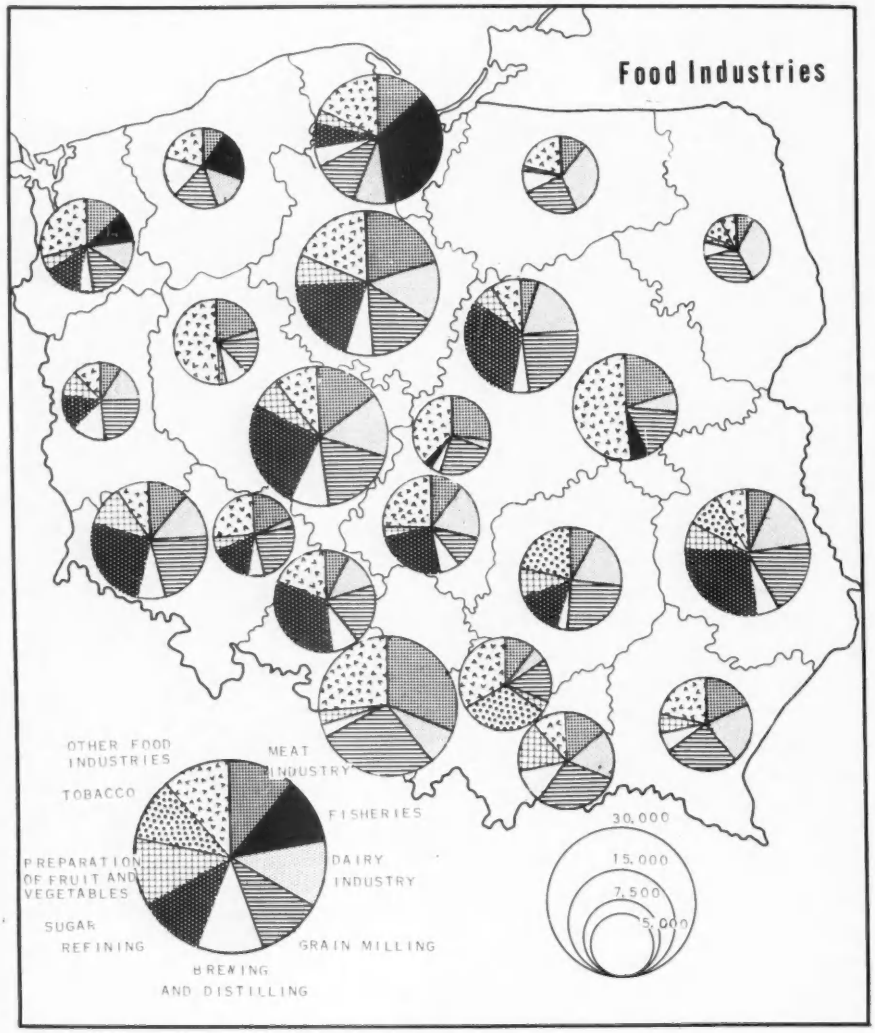


FIG. 17. Employment in the production (other than agriculture) and preparation of foodstuffs and tobacco. (Source: *Statystyka Przemysłu*, Warszawa, 1958.)

Central Poland, and Lublin, where beets have long been cultivated.

## CONCLUSIONS

The industrial geography of Poland has not been changed in any major respect by ten years of planned expansion. This growth has been one-sided and the greater part of the investment has been in the mining, steel, and chemical industries. In consequence, expansion has been greatest in areas best suited for their development (Fig. 2), those areas of the south and southwest that were already most developed. The extension of

the steel industry from *woj.* Katowice into neighboring *woj.* Kraków and the building of a semi-integrated plant in Warszawa are among the few departures from the established pattern. The intensification of coal mining in Lower and Upper Silesia does nothing to distribute industrial activity more widely; instead it exacerbates the problem of overgreat concentration in restricted areas. The heavy demands made by most branches of the chemical industry on coal, as fuel or raw material, merely draws them toward the coal field. The biggest developments, those at Kędzierzyn and Oświęcim, are both marginal to the Upper Silesian industrial complex. There is much discussion in Poland of "deglomeration" and of the need to spread industry more widely. But recent developments have, from their very nature, been highly concentrated in a few restricted areas.

At the same time the problem is discussed of "reactivating" the small towns.[26] In effect, this means bringing industries—presumably light and alimentary—to them. The areas involved are primarily the northwestern, northern, and northeastern *województwa*, but of the prerequisites for industrial growth these areas have only the labor supply.[27] A factor in the location of the Nowa Huta was the overpopulated condition of West Galicia, but no one seriously advocates a comparable undertaking in Koszalin or Olsztyn.

In any of these areas, a small degree of industrial investment is uneconomic; there must be a large investment, including the expansion of railroads and ancillary services. The State cannot, out of its limited and heavily mortgaged national income, afford a large investment. Warszawa itself is an industrial city, but the surrounding *województwo* is only very lightly industrialized.[28] It seems impossible to suggest any industry or group of industries that could be developed or expanded in this area without demanding investment that would be impracticably large and probably unwise.[29]

Two lines of development suggest themselves: the movement of labor and the use of lignite and peat as sources of industrial power in the less developed areas. The former offers little hope. The population is inherently immobile and the housing shortage in the industrial areas is such as to deter anyone who has a roof over his head from the risk of losing it. Furthermore, rural labor is usually trained only in rural pursuits. It will probably be a long time before the lignite of Central Poland is fully utilized, and it is doubtful if the peat deposits are sufficiently concentrated to be of much value. In the long run, one may expect electric power to become more readily available in the regions of Poznań and Bydgoszcz and, with it, industrial opportunities to increase. For the near future, however, it is difficult to foresee any smoothing out of industrial growth. Those regions which have will acquire more.

[26] "Studia geograficzne nad aktywizacja małych miast," *Prace Geograficzne*, Vol. 9, Instytut Geografii, Warszawa, 1957.

[27] W. Myslenicki: "Wazniejsze problemy zagospodarowania Wybrzeża," *Gospodarka Planowa*, Vol. 13, 1958, March, pp. 39–46.

[28] K. Lier: "Kierunki zagospodarowania okregu warszawskiego," *Gospodarka Planowa*, Vol. 12, 1957, January, pp. 24–30; S. Gajowski: "O właściwy kierunek rozwoju przemysłu w Woj. Warszawskim," *loc. cit.*, Vol. 13, 1958, September, pp. 48–53.

[29] An amusing article, "Drut, liny i lokalizacja," *Zycie Gospodarcze*, Vol. 12, 1957, October, reviews the problems attending the choice of a site for a light metallurgical plant. A site at Garwolin, *woj.* Warszawa, was rejected. The author concludes that the criteria governing location should be economic rather than social.

# A NOTE ON THE SAMPLE-FARM SURVEY AND ITS USE AS A BASIS FOR GENERALIZED MAPPING

*J. W. Birch*

*Dr. Birch is a lecturer in Geography in the University of Bristol. This note is based on the results of work carried out in the Isle of Man in the period 1950–1952.*

IN the January, 1959, number of this journal, Blaut discussed what he termed "the micro-regional sample survey" and its application in the quantitative study of regional agricultural geography.[1] He referred to the fact that "The possibility of using formal statistical sampling in geographic research has recently received a certain amount of attention," and quoted references to work by a number of American geographers. It may, therefore, be of interest to discuss briefly a comparable study which was carried out by the present writer.[2]

The purpose of this study was twofold: (i) the detailed examination of farming distributions, with particular reference to farming-type, using the individual farm as the unit of investigation; (ii) experiment in the use of sampling techniques for planning and operating a farm survey, with a view to providing, thereby, data suitable for generalized mapping.

Two separate samples were taken; and, on account of the diversity of farming conditions and of farming systems within the Island's 221 square miles, the sampling proportions were, in each case, as large as was practicable. The first sample ("the questionnaire sample") comprised 29 per cent (242 farms) of all the holdings of 25 acres or more; these were selected at regular intervals over the farming landscape, from the frames provided by the 1-inch and 6-inch Ordnance Survey maps. Shortage of time and initial weaknesses of technique prevented the acquisition of uniform data for all the sample farms; but questionnaires were completed, in part or in full, for 90 per cent of their number, and the remainder were covered by cross-checked secondhand information. During the course of the survey, additional secondhand data, of lesser reliability, was acquired for as many as possible of those farms not included in the sample. The second sample ("the return sample") was made up of 30 per cent (350 farms) of all holdings of 5 acres or more; these were stratified by size groups, the sampling proportions increasing with the size of holding, and the selection was made systematically from the alphabetical lists of the farms for each of the Island's seventeen parishes. This sample was taken on behalf of the Isle of Man Board of Agriculture and the farms were studied from the individual returns rendered by them to this Board on June 4, 1950.

For the return sample, a comparison of raised sample estimates of crop acreages and livestock numbers with the equivalent figures for the Island as a whole proved satisfactory. A similar check was not possible for the

[1] J. M. Blaut: "Microgeographic Sampling: a Quantitative Approach to Regional Agricultural Geography," *Econ. Geog.*, Vol. 35, 1959, pp. 79–88.

[2] J. W. Birch: "Observations on the delimitation of farming-type regions, with special reference to the Isle of Man," *Trans. and Papers Inst. of Brit. Geogr.*, No. 20, 1954, pp. 141–158.

questionnaire sample owing to the lack of complete uniformity in the character of its data. However, isopleth maps of comparable distributions, plotted from each of the samples, showed a large measure of agreement and, thus, suggested the general validity of the questionnaire sample. This agreement also encouraged confidence in the ability of the sample data to permit generalized mapping.

The questionnaire sample has, therefore, been used as the basis for a study of the Island's agricultural geography. It provides information of two types: (i) quantitative data concerning, in particular, the farmers' percentage estimates (or financial statements) of the division of their gross farm income between the various enterprises, and related statistics of crop acreages, livestock numbers, and sales off the farms, with which these estimates can be checked; (ii) qualitative data relating to the physical, economic, social, and other conditions which govern the farmers' business decisions. Examples of the use of these two types of data are given in Figures 1 and 2.

In the *Types of Farming* map (Fig. 1) eight systems of farming are indicated. They have been classified and their distributions plotted from the sample data on farm incomes, the basis of the classification being the level of significance of the dominant enterprises and the manner of their association with those of subsidiary importance. The resultant pattern is, in general, that recognized by the Manx farmers; and it accords well with the over-all comparative advantages of particular areas for individual enterprises or groups of enterprises.[3]

[3] For a brief statement of the main features of these farming-type distributions see J. W. Birch: "The Economic Geography of the Isle of Man," *Geog. Journ.*, Vol. 124, Part 4, 1958, pp. 494–513.

The second map (Fig. 2) shows the regional variations in the normal harvest period for oats, the Island's principal cereal crop. It reflects important differences in the physical conditions for farming, and is significant to an understanding of a number of farming distributions, including the localization of interest in the production of cash grain.

The principle conclusions drawn from the use of the sample-farm survey as a research technique were as follows:

1. *The reconnaissance.*—The actual survey should be preceded by a careful reconnaissance study both in the laboratory and in the field. In the laboratory, this should involve an examination of the available background information, including maps, air photographs, and statistics (in Britain the June 4th returns for all holdings of over 1 acre, collected annually by the Ministry of Agriculture and available in summarized form for parishes or blocks of parishes). The field reconnaissance which follows should have a twofold purpose: (i) the establishment of preliminary contact with local officials and leading farmers with a view to achieving the goodwill necessary for the success of the sample survey; (ii) the assessment and definition of the problems to be studied, on the basis of discussion with farmers and an examination of farms locally regarded as being typical.

Blaut recognized that his work in Jamaica suffered from a deficiency of preliminary knowledge; but his statement that the process of obtaining such knowledge would have conflicted with that of establishing "rapport" is difficult to understand. It is believed that a careful and diplomatic reconnaissance will normally be practicable and that it is, indeed, essential to the effective planning and operation of a sample survey.

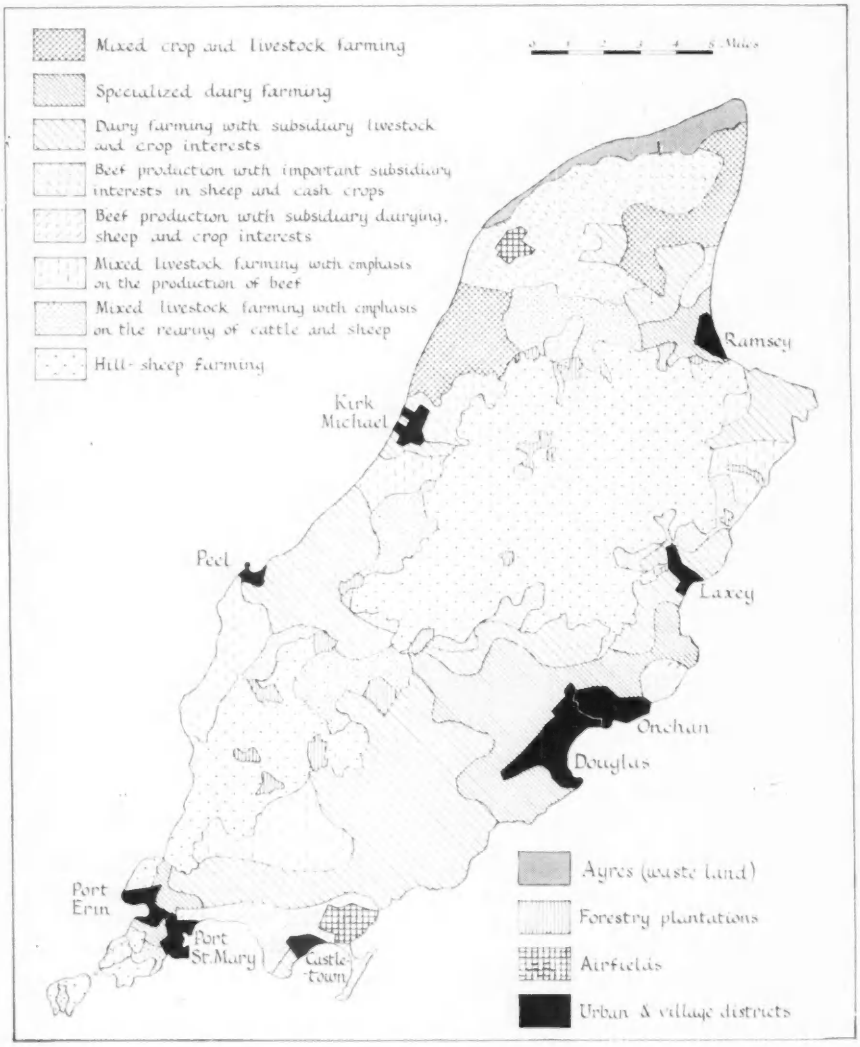


FIG. 1. Types of farming.

2. *The planning stage.*—Planning the survey involves decisions on the structure of the sample and on the design of the questionnaire.

Since the purpose of the sample survey is to provide information for selected farms, from which generalized distributions can be mapped, it is important that these farms should be distributed as evenly as possible over the required area. This can be achieved by a method of systematic point sampling, the points being provided by the intersections of a rectilinear grid superimposed on suitably scaled maps or air photograph mosaics. A farm

is selected when its land contains one or more of the sample points, and the probability of selection is, therefore, related to farm size. This results in a greater proportional representation of the larger farms which together cover the most extensive area of the farming landscape and which contribute most strongly to its functional character. The over-all sampling proportion is governed by the texture of the grid, and can, therefore, be related to such considerations as farm size, the variability of farming systems, and the availability of both time and money for the field work. A sampling method of this type has been advocated by F. Yates[4] for use in extensive area surveys, and was employed, less formally, by the writer, in the selection of the questionnaire sample farms. Certain difficulties may arise in its application when, for example, fragmented or strip holdings are common; again, when information regarding farm boundaries and sizes is not available, it is necessary to identify the sample farms and to check the sample structure in the field prior to the survey. In general, however, such difficulties can be met and they are subordinate in their importance to the advantages conferred by an area method of sample selection, namely, the assurances of a satisfactory spatial distribution of farms and of an adequate representation of the larger size groups. In a random sampling procedure these advantages are lacking, yet there are similar difficulties of application.

The questionnaire employed for recording standardized data from the sample farms should be as brief as possible. The questions should be clearly posed and each should seek only one answer. Equally, every attempt should be made to ensure the accuracy of the answers by, whenever possible, investigating each topic by two separate questions.

3. *The survey.*—Given a satisfactory sample design, the ultimate success of the survey depends on the response achieved from the individual farmers. Particular care is, therefore, necessary not only in the preparation of the questionnaire, but also in the conduct of the interview. It is suggested that, initially, permission should be sought to walk the farm to study and record the details of its layout, physiography, and use. In this way, it is possible to avoid conveying the impression that the object of the visit is simply "to pick the farmer's brains"; at the same time, the interviewer can acquire some understanding of the farmer's particular problems and his methods of tackling them. Such a procedure is most likely to gain the farmer's respect and co-operation. Given this co-operation and a thorough grasp of the questionnaire, it will often be possible for the interviewer to complete his work in the course of informal conversation, though care is necessary to avoid suggesting answers to the farmer. At each farm, the opportunity should be taken of discussing and recording, along prepared lines, the nature of the farming on the adjacent holdings, in order to provide a check on the extent to which the sampled farms are representative of their localities and not simply special cases.

In those instances where farmers prove unco-operative, the farms nearest to the sampling points should be substituted for those originally selected. It may not be possible to include such farms in the final sample computations,

[4] F. Yates: "A Review of Recent Statistical Developments in Sampling and Sampling Surveys," *Journ. Royal Stat. Soc.*, Vol. 109, 1946, pp. 25–7; and the same author's "Sampling Methods for Censuses and Surveys," London, 1949, pp. 41–42.

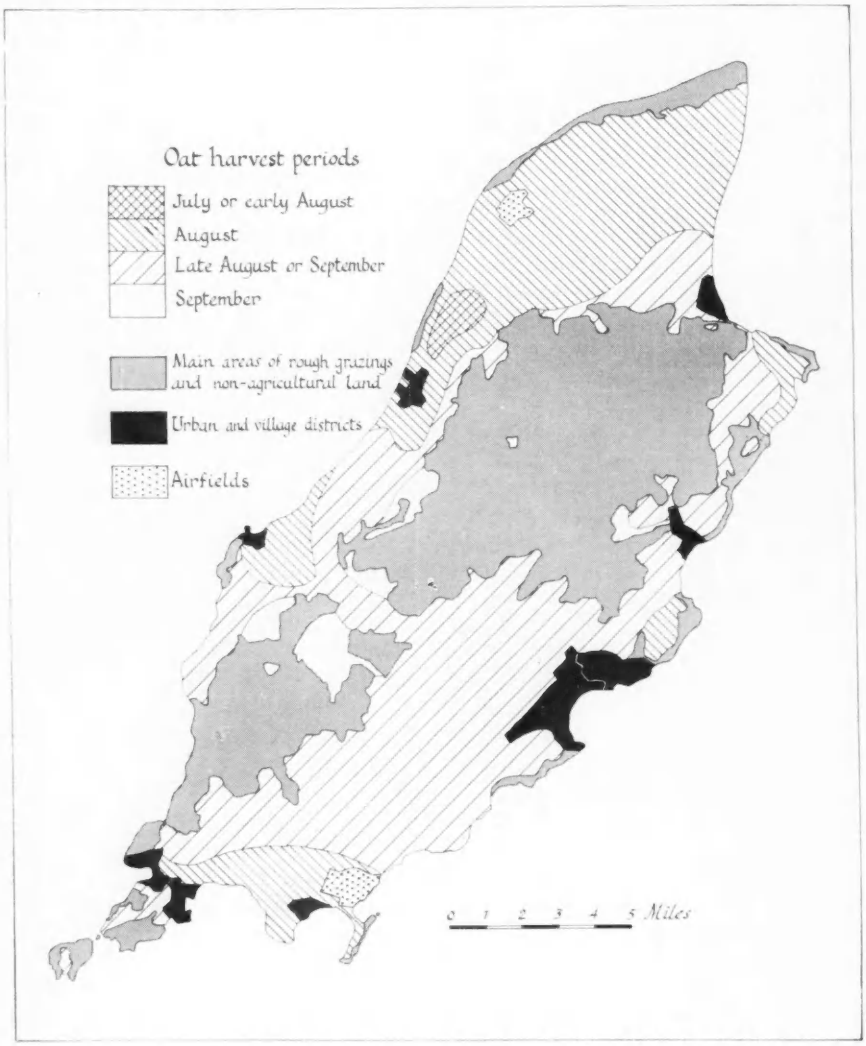


FIG. 2. Regional variations in normal oat harvest periods.

but they will, at least, provide additional supporting information.

4. *Testing the sample.*—Since the accuracy of much of the sample data depends on the farmers' powers of estimation and memory, every care should be observed in examining its validity, particularly through a critical appraisal of the internal consistency of the questionnaire. A simple test of the over-all numerical validity of the sample can be made by the raising procedure, provided that the level of response has been adequate and that data is available concerning the size of the population and certain of its

quantitative attributes (in Britain such data is generally available from the parish summaries of the June 4th farm returns). However, at this stage, specialist advice will normally be sought on the statistical adequacy of the sample. The important consideration of its spatial validity can, as suggested, be most suitably examined by discussion with farmers in the course of the actual survey.

5. *Mapping the sample data.*—The sample data can conveniently be mapped by the isopleth method. Since, however, the isopleths are required to indicate the discontinuities, rather than the continuities, in distribution patterns, the significance of their values must be ensured, either empirically or statistically. When the scale of the generalized map is sufficiently large, the detailed positioning of the isopleths can be decided with reference to the layout of the sampled farms and of those adjacent to them. A large-scale map will also permit the inclusion of the sample values from which the generalization is made.

When the sample farms prove not to be representative of the spatial distributions of the population, they may profitably be mapped separately, as special cases, either in diagrammatic form or in their true areal extent. Such situations will arise either because the farming distributions are too variable to be capable of generalization or because the sample is inadequate.

## Conclusion

Much experiment is required in the area sampling of both quantitative and qualitative data. In farm survey work, it is believed that, in the course of a reconnaissance investigation, it will generally be possible to decide on the practicability of using a sampling procedure, in terms both of the character of the population and of the resources of time and money available. In planning and undertaking a sample survey, the full objective should be the acquisition of data from which both spatial and numerical generalizations can be made and their reliability errors assessed. If, however, this full objective is not achieved, or is shown to be incapable of achievement, the results obtained will generally be more worth while than those produced by less systematic and less objective processes of investigation.

## Acknowledgments

The writer wishes to acknowledge the help received from Mr. H. C. Mackenzie in the preparation of this note.

# FACTORS IN THE LOCATION OF THE PAPERBOARD CONTAINER INDUSTRY

*Howard A. Stafford, Jr.*

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THE manner in which an industry responds to locational stimuli depends in large part on the nature of the industry, a situation which gives rise to a considerable element of uniqueness in the locational patterns of various industries. Unfortunately, there exists no general theory in which all locational patterns may be considered simultaneously. Therefore, partial analyses, each concerned with a particular industry, are desirable. The purpose of this study is to analyze the locational pattern of a specific industry, the paperboard container industry. The analysis involves three kinds of operations: (1) definition of the phenomenon to be analyzed, (2) identification of the locations in which that phenomenon appears, and (3) accounting for the existence of the locational pattern.

## Definition and Location

Descriptions employed by the United States Bureau of the Census are used to define the paperboard container industry. The census industrial classification number is 267 (which includes subclasses 2671 and 2674). The descriptions are as follows:[1]

> 267—Paperboard Containers and Boxes: Paperboard boxes (folded, set-up and corrugated), fiber cans, tubes, drums, and similar products.
>
> 2671—Paperboard Boxes—Folded, Set-up and Corrugated: This industry comprises establishments primarily engaged in manufacturing paperboard containers or boxes from paperboard or fiber stock. The chief products of this industry are folding paper boxes and cartons, set-up boxes and corrugated and solid fiber shipping containers from paperboard or fiber stock.
>
> 2674—Fiber Cans, Tubes, Drums, and Similar Products: This industry manufactures fiber cans, cones, cores, mailing cases, ribbon-blocks, spools, tubes, drums, and similar products from paperboard.

[1] U. S. Department of Commerce, Bureau of the Census, *Census of Manufactures*, 1947, Vol. II, *Statistics by Industry* (Washington: U. S. Government Printing Office, 1949), p. 332.

At the outset it was thought desirable to restrict the analysis to the continental United States. The reasoning involved in the construction of the hypotheses accepts the premises of the American economic system and is not necessarily applicable to other parts of the world. The hypotheses apply to the United States as a whole and they contemplate the use of counties as areal statistical units. Unfortunately, however, county data are not available for the entire United States, nor are data available for the whole of the industry under consideration. Mapping and testing are, therefore, limited to such figures as are presented for the 471 "large" counties

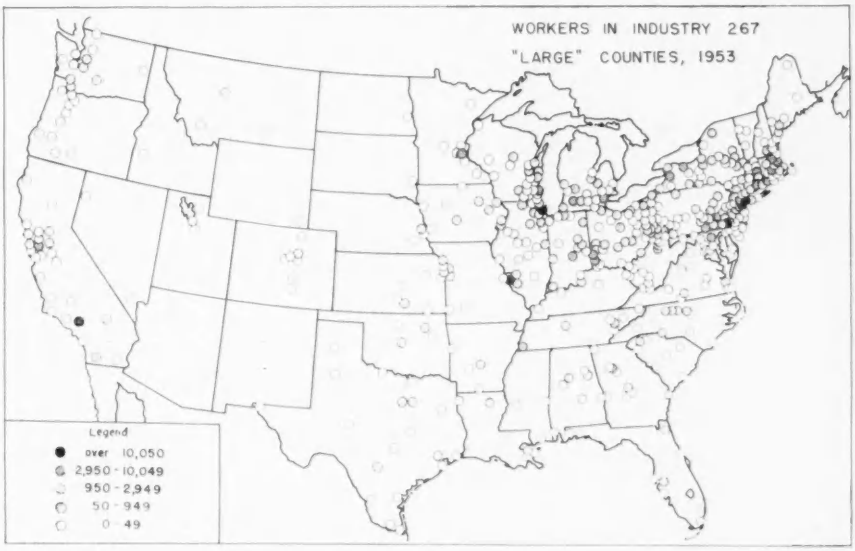


FIG. 1.

for which data are presented in *County Business Patterns for 1953*.[2]

The magnitude of an industry can be measured in a number of ways that are familiar to all students of economic geography. For this study the number of workers employed in Industry 267 is used.[3] Spatial variations in the location of workers in the paperboard container industry in 1953 (for those 471 counties for which data are available) are shown graphically on Figure 1. Since these 471 "large" counties include about 92 per cent of all workers in the industry in 1953, it is assumed that the distribution depicted by Figure 1 is representative of the industry as a whole. All of the more important concentrations are shown.

The literature of industrial location theory states that three major types of cost factors generally determine industrial location. These are the costs of (1) obtaining materials, (2) hiring labor, and (3) marketing the products.[4] Transportation costs are of great importance in the locational process; but they are not considered as independent variables in the present hypotheses, which are expressed primarily in terms of nearness rather than cost. It is desir-

[2] U. S. Department of Commerce, Bureau of the Census, and the Department of Health, Education, and Welfare, Bureau of Old-Age and Survivors Insurance, *County Business Patterns, First Quarter, 1953* (Washington: U. S. Government Printing Office, 1955). The "large" counties are chosen primarily on the basis of a large number of reporting units. A reporting unit is, generally, a single establishment or a group of similar establishments of one employer. A complete description can be obtained from the "General Explanations" section of any volume. The actual number of "large" counties listed is 480. However, in order to keep the universe on a somewhat comparable scale throughout, certain combinations of counties are not included in this study, thus reducing the number to 471.

[3] Workers are classified in regard to their place of employment rather than to their place of residence.

[4] Other cost factors, for example power costs, could be mentioned. The three cited seem to be, however, the most important in a general sense and are those most often mentioned in the literature. Two excellent references on locational factors are Melvin L. Greenhut: *Plant Location in Theory and in Practice* (Chapel Hill: The University of North Carolina Press, 1956) and Walter Isard: *Location and Space-Economy* (New York: The Technology Press of M.I.T. and John Wiley and Sons, Inc., 1956).

able to establish the manner in which variations in these three major types of costs may affect locational patterns.

## DEVELOPMENT OF THE GENERAL HYPOTHESIS

Nearness to markets appears to be of greatest importance in the location of the paperboard container industry. Establishments are said to seek market locations for two reasons: (1) to minimize transportation costs on shipping the finished products, and (2) to provide better service to customers.

Location theory, especially as advanced by Weber, indicates that high transportation costs are an important locational determinant for the set-up container segment of the industry. According to Weber's analysis, the increase in bulk (of the finished product over the materials) is tantamount to an increase in weight, thus increasing the relative importance of marketing costs and forcing firms to locate near their markets in order to minimize total outlays for transportation.[5] The hypothesis, therefore, may be advanced that the set-up-box segment is positively associated, in space, with the markets for its products.

It also appears that savings in transportation costs will be realized by the shipping container segment of the industry if it locates near its customers. Such an orientation would not be due to an appreciable increase in bulk, since shipping containers are transported "knocked down"; but the savings would accrue from locations near markets because of a rather unique system of pricing the major raw materials used in making shipping containers. These materials are virgin kraft and corrugating papers. Ninety per cent of the cost of materials for shipping containers lies in the purchase of virgin kraft and corrugating papers; and the *delivered prices for these materials are maintained at the same level throughout the United States, regardless of distances from the mill.*[6] It is, therefore, impossible for the manufacturer of paperboard shipping containers to effect any savings in transportation costs by moving closer to his supplier. Since the other materials he uses, such as cornstarch, stitching wire, cloth and paper tape, ink, and twine are of minor importance in his operations, the only significant savings he can make in terms of transportation costs must be in terms of minimizing his marketing costs. Under these conditions, a market orientation hypothesis, already advanced for the set-up container segment of the industry, seems also to be applicable to the knocked-down container segment.

The second major reason for the paperboard container industry locating near its markets arises out of its function as a "service industry." As with nearly all services, such an industry would tend to locate near its markets in order to serve its customers better. Fast, efficient, competent service would seem to be quite advantageous in this highly competitive field. Two aspects of this service feature are worth noting. First, most users of paperboard containers do not keep large stocks on hand, mainly because of the large space requirements they entail. Box makers often must supply customers on short notice; and distance from those customers is often a critical element in their ability to serve those customers promptly. Secondly, further service features arise from the fact that each producer has his own relatively unique

[5] For a detailed discussion of "transport orientation" see C. J. Friedrick (ed.): *Alfred Weber's Theory of Location of Industries* (Chicago: The University of Chicago Press, 1929).

[6] This statement has been verified by interviews with industry executives.

packaging problems. The paperboard container industry has been characterized as a job-order business.

In summary, it appears that a market orientation for the major segments of the paperboard container industry in the United States can be rationalized in terms of profit maximization to the entrepreneures through savings in transportation costs and also in terms of faster, more personalized service to customers. The general hypothesis may be formally stated as follows: The magnitude of the paperboard container industry will vary directly with variations in the magnitude of its markets.

## TESTING OF THE HYPOTHESIS

Now that the operation of the mechanism which determines locational patterns in the paperboard container industry has been hypothesized, it is desirable that the hypothesis be subjected to tests which will give some quantified measure of its validity. "The proof of a hypothesis is the testing of the hypothesis."[7]

There is, of course, no body of data that can be used to measure directly the importance and location of the markets simply because these kinds of information are regarded as confidential in the United States and are almost never released for public use. It is, therefore, necessary to discover substitute measures that are acceptable.

A large percentage of the goods consumed by the general public are packaged in paperboard containers, but it is not correct to assume orientation with respect to a general consumer market; practically all of the purchasers of the products of this industry are other manufacturers including, of course, those who produce consumer goods. When a search is made for variables that will best measure the markets for the paperboard container industry, it is not surprising that employment data for the major groups of manufacturing industries seem best suited to the task.

Six separate industry groups comprise major markets for the products of Industry 267: Food (Standard Industrial Classification Number 20); Textiles (No. 22); Apparel (No. 23); Furniture (No. 25); Machinery, except electrical (No. 35); and Machinery, electrical (No. 36).[8] There are, of course, many other industries which constitute markets of varying magnitude. Furthermore, other segments of our economy, such as retail and wholesale trade, purchase new paperboard containers. But to include all of these is not practicable, and therefore the original test of the hypotheses is restricted to measurements of spatial variation among the above mentioned industrial groups. If the association between Industry 267 and its major markets tends to substantiate the general hypothesis, the inclusion of more variables can only serve to make the statistical association more intense. While such a consequence is not at all undesirable, it is considered desirable to keep the analysis as simple as possible. The remainder of manufacturing industries cannot be ignored entirely, however, and a single additional variable, total workers in manufacturing, is included in the analysis. Its inclusion recognizes, in a general way, the fact that almost all industry uses paperboard containers in one way or another.

A more specific subhypothesis may be set up, therefore, to permit a more precise test of the general market orientation hypothesis: the areal distribution of Industry 267 will vary

[7] J. W. Mayne: "Role of Statistics in Scientific Research," *Scientif. Monthly*, January, 1957, p. 28.

[8] "End Use Distribution of Selected Containers," *Modern Packaging, Encyclopedia Issue, 1956* (Bristol, Conn.: Packaging Catalog Corp., November, 1955), p. 47.

TABLE I

MEAN AND STANDARD DEVIATIONS (IN HUNDREDS OF WORKERS) OF THE VARIABLES USED IN THE ANALYSIS OF LOCATIONS OF INDUSTRY 267 (1953)

| *Variable* | *Mean* ($\bar{x}$) | *Standard deviation* ($\sigma$) |
|---|---|---|
| Food (No. 20) | 23.83 | 65.72 |
| Textiles (No. 22) | 16.72 | 45.34 |
| Apparel (No. 23) | 22.50 | 166.82 |
| Furniture (No. 25) | 6.00 | 18.65 |
| Machinery, except electrical (No. 35) | 33.70 | 93.62 |
| Machinery, electrical (No. 36) | 21.43 | 81.58 |
| Total Workers in Manufacturing | 30.90 | 81.88 |
| Paperboard Containers (No. 267) | 2.78 | 9.10 |

directly with the number of workers in Food (No. 20); Textiles (No. 22); Apparel (No. 23); Furniture (No. 25); Machinery, except electrical (No. 35); Machinery, electrical (No. 36); and Total Workers in Manufacturing. Data for the variables for each of the counties in the universe can be obtained from the same source as the data for the dependent variable.[9] From these data the mean and standard deviation have been computed for each variable. These arithmetic averages and their measures of dispersion are presented in Table I.

Simple coefficients of correlation (r) have been computed to measure the degree of association between Industry 267 and the seven independent variables. These coefficients are listed in Table II. Coefficients of determination ($r^2$) also have been computed to indicate what portions of the variations in the paperboard container industry can be related statistically to variations in each of the independent variables. It appears that approximately 81 per cent of the spatial variation in Industry 267 can be "explained," in terms of concomitant occurrence, by variations in the location of the food industry (No. 20). Approximately 77 per cent also can be "explained" by the variations in total workers in manufacturing.

Even though the simple coefficients of correlation between the paperboard container industry and both the food industry and total workers in manufacturing are relatively high, it is felt that a more accurate description of the spatial variations in the location of the paperboard container industry in terms of concomitant occurrence with other phenomena can be obtained by taking all seven independent variables into account simultaneously.

To perform this task a system of multiple correlation has been employed. A multiple coefficient of correlation (R) can be found and a test of statistical significance applied to the independent variables. The 95 per cent confidence level has been used, and those variables not significant eliminated. However, the insignificant variables have been eliminated one at a time beginning with the lowest, since it is possible that a variable which is not significant in a certain combination may become significant after one of the insignificant variables has been dropped. In this system, if two variables measure essentially the same thing, only one appears as significant. (It should be mentioned that such variables are labeled "not significant" only in a statistical sense and only at the chosen level of confidence.)

TABLE II

COEFFICIENTS OF CORRELATION AND DETERMINATION BETWEEN LOCATIONAL DATA FOR INDUSTRY 267 AND VARIOUS OTHER INDUSTRIES (1952)

| *Variable* | *r* | $r^2$ |
|---|---|---|
| Food (No. 20) | .900 | .810 |
| Textiles (No. 22) | .473 | .224 |
| Apparel (No. 23) | .748 | .558 |
| Furniture (No. 25) | .814 | .662 |
| Machinery, except electrical (No. 35) | .654 | .427 |
| Machinery, electrical (No. 36) | .820 | .673 |
| Total Workers in Manufacturing | .878 | .771 |

[9] U. S. Department of Commerce, Bureau of the Census, and the Department of Health, Education and Welfare, Bureau of Old Age and Survivor's Insurance, *op. cit.*

Final results of the multiple correlation are summarized in Table III.

These computations make it possible to eliminate three variables from the analysis without reducing to any great extent the amount of statistical explanation afforded by the combination of the eight variables of the hypothesis. The variables excluded from the analysis are Furniture (No. 25), Machinery, except electrical (No. 35), and Total Workers in Manufacturing. The coefficient of multiple correlation (R) for all eight variables is .941, and the explained variance is almost 89 per cent. After dropping the three above mentioned variables the "R" declines only to .940 and the explained variance declines only two-tenths of one per cent.

The coefficient of multiple correlation (R = .940) is higher than any of the simple coefficients. The explained variance of 88 per cent indicates a high degree of relationship between the industry and the variables which are thought to measure the existence of markets for paperboard containers. This result tends to substantiate the general hypothesis of market orientation.

The multiple regression equation for the dependent variable and four independent variables is:

$$Y_c = .0601(X_1) + .0219(X_2) + .0154(X_3) + .0313(X_4) - .0400$$

where $Y_c$ is the estimated number of workers employed in Industry 267 and the symbols in parentheses refer to the industries for which actual numbers of workers are substituted in predicting for each statistical unit. The numbers preceding the parentheses are weights applied to the number of workers in each of these industries in order to predict most accurately on the average. In the equation, ($X_1$) refers to Food, ($X_2$) to Textiles, ($X_3$) to Apparel, and ($X_4$) to Electrical Machinery.

TABLE III

RESULTS OF MULTIPLE CORRELATION AND REGRESSION ANALYSIS (5 VARIABLES)

| *Variable* | *Beta* | *t* | *Significant** |
|---|---|---|---|
| Food (20) | .4343 | 12.5520 | yes |
| Textiles (22) | .1092 | 6.3121 | yes |
| Apparel (23) | .2825 | 14.1250 | yes |
| Machinery, electrical (36) | .2811 | 9.3700 | yes |
| R = .940 | | | yes** |
| $R^2$ = .884 | | | |

*The least significant value of t is 1.965.

**The least significant value of R with N = 471 and m = 5 is .145.

An estimate for each of the 471 counties in the universe can then be made from the regression equation. Deviations of the predicted values from the actual values are noted ($Y_c - Y$). The standard error of estimate ($S_{y.1234}$) has been computed and found to be substantially lower than the standard deviation of the distribution of the dependent variable. The standard deviation of Industry 267 is 9.10 (00's) while the standard error of estimate is only 3.09 (00's). In other words, on the average better predictions can be obtained from the regression equation than from the mean of the dependent variable.

Deviations of the actual values from the predicted values ($Y_c - Y$) have been placed in their respective counties as shown on Figure 2 (Accuracy of Estimate Map). Those counties of over- or under-prediction of more than one standard error are specifically noted. The chief purpose of mapping the performance of the regression equation is to gain an insight into some other relevant variables that might further explain the distribution of Industry 267.

A comparison of Figures 1 and 2 reveals that the regression equation predicts well for those counties with very few workers in the paperboard container industry. A cursory examination reveals that, for the most part, these counties have very little manufacturing of any kind. These observations seem to strengthen the hypothesis that there

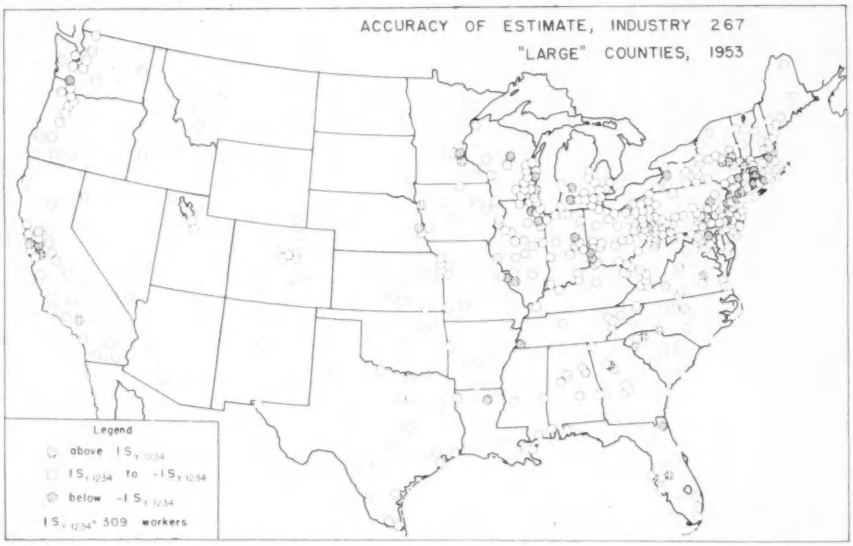


FIG. 2.

will not be many workers in Industry 267 in those areas that do not provide markets. Areas of extreme over- or under-prediction are generally counties of moderate to heavy concentrations of workers in the industry. There are, of course, counties that have many workers in Industry 267, such as those in Chicago and New York City areas, which are very well predicted.

To obtain a complete analysis of any particular county requires a detailed study of that area and consideration of many more variables. However, to increase the ability to predict more accurately for the industry as a whole, attention should be directed primarily to those variables which appear to be of importance in those counties of extreme over- or under-prediction.

The inability to estimate well in certain counties may not be due to deficiencies in the market orientation hypothesis or in the variables used in the statistical analysis. The poor estimations may stem from the fact that market areas for paperboard container plants do not necessarily follow county boundaries. It is quite possible that a container producer may be located immediately adjacent to his market, but be separated from it by a county boundary, leaving the association completely unmeasured by the data. It appears that such situations might actually exist in several cases where counties of over- and under-prediction are adjacent. Prominent examples appear in certain counties just outside New York City, in Connecticut and Massachusetts, and in the St. Louis and San Francisco areas.

Problems and procedures involved in the analysis of the paperboard container industry resemble closely those that appear in many aspects of research in economic geography. Progress in that discipline has often been said to depend on the discovery of generalizations that can be elaborated only after many studies of these types have been made. The present study may constitute a small contribution to that end.

# TEA—A NEW AGRICULTURAL INDUSTRY FOR ARGENTINA

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THE tea plant (*Thea sinensis* (L) Sims) was introduced into South America from China in the early 19th Century,[1] but, for more than 100 years thereafter, the several attemps to establish tea as a commercial crop proved, in almost every case, to be discouraging failures. During the first World War South American interest in tea growing revived, and Peru and Brazil developed moderately successful tea industries.

Argentina is the most recent of the Latin American countries to inaugurate the production of tea, and, due to the industry's rapid growth, that country is now the principle tea producer in the western hemisphere.[2] At present, Argentine tea growers adequately supply the home market with more than six million pounds annually, and have already planted sufficient acreage to produce more than fifty million pounds by 1961. A survey of the Argentine tea industry brings to light a number of problems which to some degree are shared with other producing countries in Latin America, and provides an interesting case history for those who have speculated upon the tea-growing potential of the vast area of the American tropics and subtropics.

## Growth of the Argentine Tea Industry

As early as 1924 the Argentine government distributed seed from China to interested farmers and sponsored trial plantings in the provinces of Misiones and Corrientes, and east of the Alto Paraná River in the provinces of Chaco, Formosa and Tucuman.[3] About this time also, experimental plantings were attempted by several foreign colonists on their own initiative in various pioneer settlement zones of Misiones.

In Misiones particularly these experiments demonstrated the suitability of the tea plant to local soil and climatic conditions, but lack of an adequate experienced labor force and the prevailing low price of tea on the world market precluded development of plantations on a commercial scale. By this time, also, most colonists had turned to the planting of *yerba mate*, and, later, tung, as more lucrative and reliable sources of income.

In 1936 the Argentine government

*Data for this study was collected while the author was engaged in geographic field work in southern South America, which was supported by the Foreign Research Program conducted by the Division of Earth Sciences, National Academy of Sciences—National Research Council, and financed by the Geography Branch of the Office of Naval Research, under Contract Nonr-2300(09).

[1] Tea seems to have been first introduced into South America by Dom João VI who brought seeds to Brazil in 1812 and fostered the establishment of commercial plantations. (García Fírbeda, M. "El té." *Revista de la Faculdad de Ciencias Económicas*, Univ. de Buenos Aires, Año 6. No. 55–56, Julio-Agosto 1953, p. 712.)

[2] Comparative tea acreages for South American countries, 1958, from official statistical sources of governments involved: Argentina, 84,000; Brazil, 12,200; Peru, 4500. Small amounts are also grown in Bolivia, Colombia and Paraguay.

[3] García Fírbeda, *op. cit.*, p. 714.

TABLE I

| Province | 1950 | | 1955 | | 1958 (est.) | |
|---|---|---|---|---|---|---|
| | Number of plantations | Acres planted | Number of plantations | Acres planted | Number of plantations | Acres planted |
| Misiones | 811 | 3,270 | 11,516 | 76,883 | 11,650 | 79,000 |
| Corrientes | 6 | 204 | 137 | 3,317 | 150 | 5,000 |
| Total | 817 | 3,474 | 11,653 | 80,200 | 11,800 | 84,000 |

prohibited new *yerba* plantings in an effort to forestall overproduction. Also by 1939 the price of tea on the world market had recovered sufficiently from its earlier slump to make tea plantings once more economical. However, it was not until the second World War had drastically curtailed foreign imports that farmers in the northern Mesopotamian provinces were tempted to initiate plantings for the supply of the small but growing domestic market.

The fledgling tea industry prospered with the general boom in the Argentine economy from 1942 to 1952. In 1954 the government offered tea planters price supports and tariff protection, thus stimulating greater intensification of cultivation. Accurate statistics of acreage and production are difficult to obtain, and there are great discrepancies in figures from various sources. Data for 1950 and 1955 in Table I are derived from a census of the tea industry undertaken in 1955 by the *Dirección de Estimaciones Agropecuarias, Ministerio de Agricultura y Ganadería*. 1958 estimates are based upon interviews with Argentine growers and processors.

In 1950, Argentina produced approximately 2,300,000 pounds of finished tea from some 3500 acres; by 1955 over 80,000 acres had been planted and production rose to approximately 4,000,000 pounds. The planting of new acreage has been sharply curtailed since 1956 as a consequence of lowered prices due to threatened overproduction, and uncertainty regarding government agricultural policies after the 1955 revolution. However, growers estimate that the 1958 crop will reach 6,500,000 pounds, and that in 1961, when most of the planted acreage will have reached the producing age, productive capacity will surpass 50,000,000 pounds of finished tea.[4]

## THE PRODUCING REGIONS

At present, Argentine tea production is restricted to the northern Mesopotamian provinces of Misiones and Corrientes.[5] The center of the industry is the Oberá-Campo Viera-Campo Grande region in south-central Misiones, from which comes an estimated 80 per cent of Argentina's total production. The shore zone of the Alto Paraná River in Misiones from Santo Pipó north to Wanda accounts for approximately 15 per cent. The remainder of the commercial tea plantings are located in Corrientes near the town of San Carlos, a few miles from the Misiones boundary (Figs. 1 and 2).

The tea lands of the principal producing region are located in the rolling uplands of the Sierra de Misiones at altitudes of between 1000 and 1500 feet, and to the south in the Sierra de Itacuara at slightly lower elevations.

[4] In 1950 about one-fourth of the tea acreage had reached the productive age, considered in Argentina to be three years. In 1955, less than one-tenth of the trees planted were in production.

[5] Trial plantings were also recently initiated in the provinces of Salta and Chaco.

FIG. 1.

The nuclei of tea acreage as well as the centers of elaboration are closely tied to the principal road of the region (*Ruta* #14) which connects central Misiones with the provincial capital at Posadas on the Alto Paraná River, and with road and rail routes to Buenos Aires. Along this route, tea plantations may be observed from Leandro Alem in the south to Dos de Mayo in the north in a zone varying in width from one to 25 miles.

The climate of central Misiones, and for that matter throughout the tea producing region, is humid subtropical. The average conditions of 75 inches of rainfall and a mean annual temperature of 70° F. in general favor the tea growers. However, rare severe winter droughts are a potential threat to plantings.

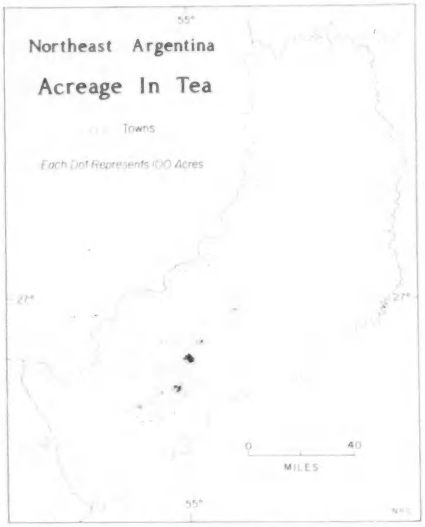


FIG 2.

Also, mild frosts are common from May to October and occasionally temperatures drop as low as 11° F., which is sufficient to destoy new plantings. Most growers manage to minimize the frost danger by placing plantations on the higher hill slopes in the Sierra de Misiones. In such upland locations killing frosts are virtually unknown, and the picking season is often a month longer than that in the intervening swales. Soils are chiefly deep, reddish, friable clay loams and sandy loams developed from weathering of the Paraná plateau basaltic lavas. Such soils erode easily, but are moderately fertile and mildly acidic—the latter an important factor in the ecology of the tea plant.

To the natural hazards of the agriculturist in Misiones must be added the problem of the leaf-cutting ant, which rapidly acquired a taste for young tea plants and is a serious threat to new plantings. The voracious pest can be effectively controlled by continual use of chemical poisons, but prices of ant poisons are prohibitive for the majority of farmers.

The production of Argentine tea is almost entirely in the hands of foreign agricultural colonists who came to Misiones beginning in the 1920's, and this fact has had important consequences both in the location and agricultural patterns of the industry.[6] The commercial possibilities of tea failed to interest the colonists in the older settlements along the upper Alto Paraná River, who already possessed profitable perennial plantations of *yerba mate* and had no new land available. However, tea gained a strong foothold in newer settlements in the Oberá-Campo Viera region where many colonists settled after the government ban on new yerba plantings, and the agricultural base had developed upon annual crops.[7] Immense profits earned by German and Slavic colonists fortunate enough to possess producing acreages during the period of war-induced shortage tempted many colonists to initiate plantings, and tea spread rapidly throughout central Misiones and south into adjacent Corrientes. By 1952 many yerba growers along the Alto Paraná were planting tea in new lands purchased especially for the purpose.

It is important to note that even during the period of exceptional prices few colonists were willing to risk everything on the speculative new crop, and tea generally was planted as a small but profitable side line. In 1953 the government eased sanctions on yerba planting and newly cleared forest was more often than not put into yerba. Thus today only a few large-scale

[6] Almost all European nations, as well as Japan, are represented by colonists in Misiones. Germanic and Slavic peoples (Poles, Ukranians, etc.) are the most numerous and these two groups grow and process the bulk of Argentine tea.

[7] Principally cotton, tobacco, maize, and manioc.

growers are engaged exclusively in tea production; the bulk of Argentine tea is still produced by colonists whose energies are primarily concentrated on other agricultural pursuits.

Owing largely to the association of tea with colonization in Misiones the typical plantation pattern of large landholdings has not developed with the industry. The size of farm lots in the colonies located in the forest zones of Misiones is established by government regulation, and normally varies from 60 to 125 acres. However, few farmers have prepared more than half of their land for agriculture and, as mentioned previously, fewer still devote all their cleared land to tea. The average tea plantation in Misiones is about eight acres, but size ranges between one acre and 900 acres.[8] The few colonists who have more than 50 acres of tea have been forced to acquire other lots to expand production. Only rarely are these contiguous with the original lot and in some cases the nearest land available for purchase is located in new colonies 20 to 40 miles distant. The tea plantations of Corrientes are an exception to this "anti-latifundia" pattern. Here several planters were able to buy blocks of grassland outside of organized colonies (up to 2500 acres) and these have been planted entirely to tea.

## AGRICULTURAL PRACTICES

Almost all agricultural techniques employed in the production of Argentine tea have been developed through study of available literature and by trial and error. Many growers, particularly those along the Alto Paraná, have made extended visits to central Misiones in order to profit from the experiences of established planters. However, apparently no colonists came to Argentina from established tea-producing regions; hence there was no reservoir of skills available for production of the crop. In the last several years, a few experts from Great Britain and Japan have been employed for short periods of time by planters in Oberá and Campo Viera and their suggestions have been generally shared throughout the tea-growing region. However, farmers frankly admit to lack of adequate knowledge of tea growing and processing, and the processes of study and experiment are still characteristic of the industry.

The most common tea varieties planted are Assam hybrids. In Misiones these varieties are by far the best producers, but are sensitive to frost and drought, and some growers prefer the hardier, though inferior-yielding, Chinese varieties. One large plantation of approximately 1000 acres is turning exclusively to the Darjeeling variety. Unfortunately, lack of familiarity with tea and lack of care in plant selection among the rank and file of growers has led to rapid degeneration in the tea varieties, and, in many fields, bushes with a wide variety of unfavorable leaf, bud, seed, and stature characteristics may be observed.

When possible, tea is planted on land newly cleared of imposing subtropical forest. Trees are felled and allowed to dry, then are pushed into piles and burned. Since the land is planted almost immediately to tea, tree remains cannot be burned more than once, and a considerable amount of debris and stumps are left in the field to rot—a process taking more than 20 years in the case of some hardwood

[8] Based upon the official 1955 census of the industry (Table I). In a 1958 census of members undertaken by the Cooperativa Oberá, one of the largest agricultural cooperatives in Misiones, approximately 1000 members possessed 9500 acres of tea, for an average of 9.5 acres per farm. (Figures courtesy of Mario A. Ortiz, statistician, Cooperativa Oberá.)

trees. On such land, plowing is impossible and preparation for planting must be accomplished with a hoe. In Corrientes, where tea has been planted in large blocks on the rolling grasslands, contour plowing preceded planting, and, in a few cases, shallow terraces were formed.

Tea is planted during the winter rainy season from May to July. Seeds are planted directly in the field rather than in *viveros* (protected seed beds) owing to the relatively high cost of labor for transplanting. It is also claimed that bushes so planted reach harvesting age at least a year earlier than those beginning life in a *vivero*. Five to ten seeds are placed together several inches beneath the surface and for the first year are partially protected from the sun by a row of short bamboo stakes or cones of thatch. Under optimum conditions, 70 to 80 per cent of the seeds germinate, and thinning is left mainly to natural selection. Spacing between plants is 3 x 8 feet. This interval is somewhat greater than normal in other tea-producing countries, and is perhaps a result of wholesale imitation of a few early large-scale planters who hoped to introduce machine harvesting, or the desire of colonists to protect themselves against the insecurity of the new tea industry by leaving room for other crops. Several growers, on the advice of a British expert, have planted tea in double rows with the usual wide interval between, but the practice is not common.

The extent to which inter-tillage of tea with other crops is carried on seems indicative of the unwillingness of many colonists to rely wholly upon tea as a source of income. Almost all planters harvest several crops of maize, beans, manioc or tobacco before the bushes reach picking age, and some continue the practice long afterwards. In central Misiones, many growers alternate rows of tea with perennial plantings of yerba and, more rarely, tung. However, here and in Corrientes, the few large-scale growers are not generally inclined toward such inter-tillage, and along the Alto Paraná, where most colonists already possess large *yerba* groves, tea is generally unaccompanied by other crops.

Once the tea has been planted, most plantations receive only a minimum of attention. In plantings on newly cleared land the use of machinery is impractical, but also older plantations no longer cluttered with stumps and other tree remnants are left uncultivated or at most disked once annually. Weeds are controlled by hoeing, which must be carried on constantly. A few colonists grow leguminous cover crops between tea rows to protect and enrich the soil, and some have planted rows across rather than down the slope of their farms, but on the whole there is little apparent consideration among growers for basic conservation practices.[9] The several large-scale growers devoted exclusively to the production of tea are attempting to apply some modern scientific farming methods to their plantations, but these are still in the experimental stage and are not yet part of the basic agricultural pattern. Even on up-to-date plantations, tea grows without the protection of shade trees and plants are not pruned as they are in other tea producing countries.

Ordinarily, bushes are picked after the third year of growth, which is one to two years earlier than is customary elsewhere.[10] Picking generally begins

[9] This is apparently characteristic of pioneer agriculture as a whole in Misiones. (See Wilhelmy, Herbert: *Siedlung im Südamericanischen Urwald*, Hamburg, 1949.)

[10] In some cases 2-year old bushes were harvested during the height of the boom, but this practice has almost disappeared.

in September and extends into February, but may occasionally be shortened as much as a month by late frosts. The picking season consists of two "flush" periods, during which the plants sprout continuously and are picked weekly. The spring flush, from late September to middle November, provides the highest yield. After a short rest throughout the month of December the trees experience a second flush during January. At present all picking is done by hand. Nominally, the bud and the first two leaves are removed from the shoots, but, unfortunately, laborers are not particularly discriminating, owing largely to lack of experience. Several growers have attempted unsuccessfully to harvest with improvised machinery, but many hope eventually to acquire the necessary equipment from abroad.

Most of the agricultural labor required in the production of tea is provided by itinerant *mestizos*, almost 85 per cent of whom are Paraguayans lured across the border by high wages.[11] Fortunately, the beginning of the tea harvest coincides with the end of the *yerba* harvest (August) and there is thus usually sufficient labor available when required. Even during periods of inactivity in other phases of agriculture in Misiones, a disproportionately large share of the work is done by women and small children. Owing to the present low price of tea and to a recent pay-raise for laborers instituted by the government, wages are currently almost prohibitive to growers. Many colonists who arrived after World War II are not yet in a position to afford outside help and are still dependent upon the labor resources of their family—a factor which has helped to restrict the size of tea plantations.

[11] Since agriculture in the pioneer zones of Misiones early developed on the basis of perennial crops (yerba, tung, citrus), colonists have tended to become "planters" rather than "farmers" and most of the actual labor is done by hired hands. (Wilhelmy, *op. cit.*, pp. 70 ff.)

## PROCESSING AND MARKETING

In the early stages of the Argentine tea industry most colonists attempted to dry the leaves from their groves in hastily constructed sheds, and even in their kitchens. By 1951 some 300 enterprising growers had built small *secaderos* (processing plants) modeled after British prototypes, and the pattern of individual farmers processing their own harvest began slowly to disappear. From 1951 to the present, the trend toward consolidation has continued as the industry has become better organized, and demand for improved and standardized quality for home consumption and export has increased. In 1958, there were still approximately 240 secaderos, concentrated heavily in the Oberá-Campo Viera region (Fig. 3).

Some ten large secaderos with annual productive capacity of more than 50,000 pounds of finished tea have been built and these now process approximately 65 per cent of Argentina's tea harvest.[12] The large secaderos were built by growers possessing sizable tea plantations in order to provide for the processing of their own crop. However, most seem to have over-estimated their needs and must buy green leaf from small-scale planters in the vicinity. But even with purchase of leaf from others, few secaderos operate at full capacity. In order to insure a steady flow of green leaf, owners of secaderos in some cases have contracted with neighbors to plant tea, and most employ *cuadrillos* of laborers during the harvest season

[12] The largest secadero is that of "Industria Té Argentina" at Campo Viera. When construction is finished in 1960, capacity will be approximately 4,000,000 pounds of finished tea per annum.

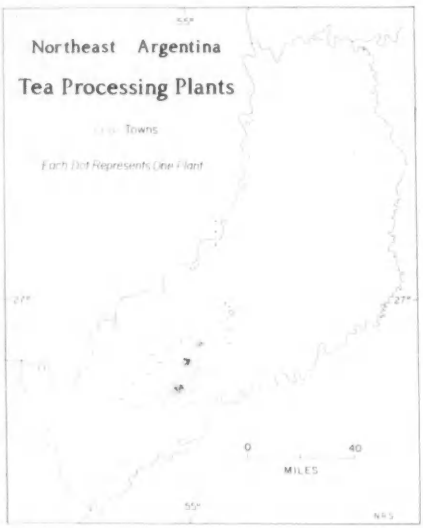


FIG. 3.

to pick the groves of other planters. Such secaderos ordinarily serve 70 to 100 colonists within a radius of 25 miles, but colonists outside the areas of concentrated production who have elected to plant tea must haul their harvest by truck or cart for a distance of 50 miles or more.

The techniques employed in secaderos, as on the plantations, have been developed through experiment and improvisation with occasional suggestions from visiting British and Japanese experts. Only rarely have colonists been able to accumulate sufficient capital to import machinery, and most rollers, ovens, and other necessary equipment have been copied by Argentine machinists from British models, or have been improvised from pictures or diagrams. While the better-made of such equipment seems to function adequately, most is below the standard necessary for consistent quality of the finished product. Moreover, even native-built machinery is in short supply, and, by the 1960 harvest, the shortage will be critical.

Technicians responsible for the operation of the secaderos have accumulated their skills rapidly through trial and error, and most still lack sufficient experience to organize secaderos, and to control the processes of wilting, fermentation, and drying. Inexperience has caused the greatest difficulty in classification of dried tea in accordance with the elaborate British system that has become the world standard. Several secaderos are at present able to produce fine-flavored teas, but outside Argentina these have received low quality ratings due to improper grading. Almost all the tea is processed in the form of "black tea"—primarily of "Orange Pekoe" and inferior grades. Several Japanese colonists produce "green tea" for consumption by the approximately 100 Japanese families living in Misiones.

At present all tea produced in Argentina is consumed within the country. A few of the large secaderos package their tea on the estates and market it under their own brands. However, most secaderos in Corrientes and central Misiones send tea in bulk by truck and less frequently by rail to Buenos Aires. Secaderos along the Alto Paraná River lack rail connections and send most of their tea south to the capital by river boat. In Buenos Aires, bulk tea is sold to "*fraccionadores*" who package it under more than 40 different brands for the retail market. But, regardless of the method of packing and shipping, the marketing of tea is poorly organized, and often it must be stored for months on the estates.

## PROBLEMS AND PROSPECTS

The Argentine tea industry has passed the peak of prosperity based upon

wartime shortages and government manipulation, and it is now faced with problems typical of industries that grew too rapidly in response to artificial stimuli. During the period of high prices, inexperienced growers with improvised methods stripped trees and rushed their product to market. As a consequence, Argentine tea earned a reputation for poor quality from which it still suffers. Inferior quality prejudiced Argentine consumers against the home-grown product, and producers seldom bothered to acquire technical skills necessary to produce a tea marketable under competitive conditions.

The factors of poor quality, competition from foreign teas, and lack of organization and coordination among growers have created serious overproduction that has brought the industry to the verge of crisis. The market for tea in Argentina is relatively small.[13] The 1957–1958 harvest of 6.5 million pounds was approximately equivalent to present consumption. Growers estimate that the 1958–1959 harvest will be twice that amount, and that, even without new plantings, 1960 production will be nearly ten times the absorbtive capacity of the local market.

It is obvious to most growers that survival of the industry now largely depends upon the ability to find foreign markets, and that this in turn will require a vast improvement in the quality of Argentine tea. The shift in emphasis to quality has already resulted in the closing of numerous small "home" secaderos. Owners of moderate-sized and large secaderos are beginning to invest in improvements and seek advice from foreign experts on problems of growing and processing. Several have sent large samples of their product to London and Amsterdam, where they have been judged equal to medium-grade Asian teas. However, foreign buyers are not yet convinced that Argentina can consistently produce tea of high quality, and are demanding further improvements, particularly in grading.

In addition to the problem of quality, tea growers are confronted with other difficulties in marketing their product abroad. The relatively high cost of agricultural labor leaves the grower with little profit at present prices and the demands of the laborers are certain to increase in the near future. Fluctuations in Argentine currency have also worked to the disadvantage of tea growers who have been forced by the government to exchange the Argentine peso at less than one-half its free market value.

Progressive growers have taken the initiative in the stabilization of the tea industry, and many others are following their example. However, both planters and secadero owners feel that further advancement of the industry is beyond their capabilities, and they are looking to the Argentine government for help. The government responded in September, 1958, by formation of an *Instituto Nacional del Té*. This institute, composed of cabinet ministers, bankers, and planters, will use funds derived from government loans and taxation of the industry to conduct a census of growers as a basis for study of present problems. The group is also authorized to finance research needed to bring Argentine tea to competitive quality on the world market, and to aid in marketing. If the institute proves successful, tea may well become an important element in the agricultural complex of the

[13] Owing, in part, to the consumption of *yerba mate*, the traditional beverage of southern South America. However, growers feel that due to the recent European origins of an increasingly large segment of the Argentine population, it is possible at least to double present consumption provided quality is improved and prices can be made reasonable.

northeastern pioneer zone, as well as a valuable asset to the Argentine national economy. If solutions to the many problems facing the industry are not achieved, it is likely that tea production will decrease markedly to a more realistic adjustment with Argentine consumption, and will be concentrated among the few growers and processors who are financially able to invest in the substantial improvement of their product.

# BOOK REVIEWS

*Perspective on the Nature of Geography*, by RICHARD HARTSHORNE. ix and 201 pp.; bibliogr., indexes. Rand McNally & Company, Chicago (for Association of American Geographers), 1959. $5.00. $8\frac{3}{4}$ x $5\frac{1}{2}$ inches.

To give a comprehensive and detailed critique of a book so compact of closely-wrought argument as this is, on anything like the scale it deserves, is clearly impossible in a few hundred words. I will, therefore, content myself with indicating, without analysis, what appear to me strengths and weaknesses, and with a personal assessment of Hartshorne's position in current geographical thinking in English.

The book is what it claims to be: a perspective, twenty years after, on *The Nature of Geography*—and the nature of geography in the broad; a perspective which, if it induces modification in detail, emphasis, and expression, yet leaves the major lineaments of the earlier book intact. Although, for example, the famous definition "the science of areal differentiation" is ostensibly jettisoned, this is in form not fact: there is no real change, merely a refinement of expression into an "accurate, orderly, and rational description and interpretation of the variable character of the earth surface" (p. 21; a definition further modified but not substantially changed on p. 172). This is, in my opinion, much clearer; but for some it will have the disadvantage that it does not lend itself quite so easily to parrot-like repetition. It is, I think, fair to say that the tendency is throughout towards a clearer and more simply expressed reformulation of the positions of the earlier book.

Each reader will, of course, find his own occasions for applause or disagreement and may feel that the argument is here too fine-drawn, elsewhere not quite pushed home—though the latter case will be rare. For example, I am in agreement that the "physical" or "natural" versus "human" dichotomy is in general false—there is no abstract environment, only "environment for what?"—but here and there the argument in Chapters VI and VII might well encourage, amongst weaker brethren, a sort of anthropo-solipsism. Is it quite true that the antithesis of Man and "Nature" is altogether a recent invention (pp. 48–49)? In words, yes; but I have a suspicion that in earlier centuries the deep underlying concept was expressed with the word "God." Again, acute as the discussion of Time and Genesis is (Chapter VIII; genetical geomorphologists will not like this at all), one feels that the case is rather overstated. Even for a layman, the English Weald is simply not comprehensible without some reference to origins, which takes us back at least to the Alpine orogeny, and indeed the critique of Wooldridge and Linton at this point (p. 91) seems to confuse apprehension with comprehension: if my wife should desert me without warning, I would most certainly apprehend that event, but I might not comprehend it at all. Here I feel that some of Hartshorne's arguments provoke a scepticism such as Berkeley provoked in Hume: "they admit of no answer, and produce no conviction." Nor are Free Will and Determinism entirely irrelevant: at the least they are important subjective factors in the geographer's mind.

But by and large the book is splendidly argued. Over and over again the ruthless following of the argument pays off, even though it is naturally and rightly not quite so thoroughgoing as in *The Nature of Geography:* as Hartshorne says, in a salutary warning against that habit of mind which begins the historical geography of a London suburb in the pre-Cambrian (this is not parody!), "we cannot follow every root to its deepest end; somewhere the scholar must cut off the diminishing returns" (p. 99). How much scholarship, that if more modest in aim and technique might have been more effective in result, never sees the light of day through neglect of this elementary economic principle!

To me, the finest chapters are those (IX-XI) dealing with geography as systematic or regional, nomothetic or idiographic (but, as Hartshorne magnificently demonstrates, we should say not *or* but *and* all along the line), and with its place among the sciences: if not gold unalloyed, these are 90-odd per cent pure. Can a region be better defined than as "an area of specific location which is in some way distinctive from other areas and extends as far as that distinction extends" (p. 130)?—a definition which the imperceptive may write off as verbiage, but which cuts right through the metaphysical dubieties and the futile questioning of "what sort of region?" A careful reading of Chapters X and XI should dispel those vasty gloomings as to the scientific respectability of geography which so inhibit some geographers from doing the good work they could do. From a discus-

sion of what "science" and "scientific" really mean, "we can replace the question, 'Is geography a science?' by the much more useful question, 'What kind of science is geography?' " (p. 170).

What of Hartshorne's place in the general geographical scheme of things? Here there may be, in the longer perspective, a certain ambivalence—paradoxically, because he does his job too thoroughly. He sets out to stimulate thought; and for those who do not take their thinking ready-made, he succeeds. It is not possible to read Hartshorne and to go on taking naively inherited postulates for granted; one must search into oneself, not be content with knowing what one means but make very sure that one means what one says: an irritant stimulus, doubtless, but how stimulating! But the others? No man who argues so carefully is to be held responsible for his epigone, and—except perhaps in his reaction to Schaefer, not unprovoked but in my judgment a lapse from his own standards—Hartshorne does not proclaim himself as pontifex: nothing could be in better taste, or show more common sense, than the "Afterword" to this book. But then, that erudition of the man who seems to have read everything, that assurance in methodological terminology, that remorseless logical follow-through—great is the temptation for the timid and the lazy to huddle under those capacious wings, and from that unmerited shelter to peck at heresy. I have seen references to Hartshorne more suited to the founder of a sect than to an honest seeker after right method.

But that is neither Hartshorne's intention nor his fault: it is incumbent on the honest seeker to follow through his search, be the consequences for the weaker brethren as may be; after all, they would climb onto any other band wagon that come along, and few are so well-found as his. For the rest, we may disagree, sometimes strongly, surely in detail and perhaps even in sum; but we will not refuse respect and gratitude to a man who has done so much for the precision of our tools and to maintain for our study its ancient and proud place in the world of learning.

O. H. K. SPATE

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*Multiple Purpose River Development*, by JOHN V. KRUTILLA and OTTO ECKSTEIN. xiv and 301 pp. Published for Resources for the Future, Inc., by Johns Hopkins Press, Baltimore, 1958. $4.50. 9¼ x 6½ inches.

Although an economic efficiency criterion for federal water resource projects has been an explicit requirement since adoption of the Flood Control Act of 1936, weaknesses both in the theory and practice of project evaluation have engaged the attention of many students. This study by Krutilla and Eckstein is one of the most important contributions to date in the field. Its fundamental concern is the search for the most economically efficient organizational structure for water development. In this search the authors examine and compare federal, private, and "partnership" development and make penetrating observations. It is hardly necessary to observe that there is no relationship between this objective analysis and either the vast literature arguing the relative merits of public and private development or the methodological manuals such as the Federal Inter-Agency River Basin Committee's "Green Book." That major questions and uncertainties remain is a measure only of the complexity of the subject, not of the importance of the work.

The authors assume that economic efficiency is one of the important criteria for evaluating water resource developments (but acknowledge the existence of other and perhaps higher social criteria). As a basic framework for their study, they develop a model of a perfectly competitive economy, showing the relationship between demand, prices, and efficiency criteria in the allocation of resources among producers and products among consumers. The authors then, to the comfort of the empiricist, point out how certain characteristics of water projects cause complicating departures from the competitive conditions of the hypothetical model. The major problems stem from the inability of the market mechanism under prevailing institutional arrangements to cope with questions growing out of the interdependence and indivisibility of projects and project functions. To supplement the market mechanism, the authors accept benefit-cost analysis as a guide to achieving efficient use of public revenues. They argue, however, that the arbitrary interest rates used by the federal agencies in their economic appraisals are not a true measure of the social cost of capital raised by federal taxation. A long chapter is devoted to an accounting-type analysis of the incidence of federal taxation and the interest earnings available to the various categories of taxpayers if the income taxes were reduced. This analysis yields a rate of 5 to 6 per cent as the "true" cost (alternative opportunity value) of federal financing.

The rest of the book is devoted to empirical analyses, in the light of the foregoing, of three case studies where alternative development proposals have touched off controversy: the Hells Canyon reach of the Snake River, the Alabama-Coosa River system, and the Willamette River Basin.

The Hells Canyon case illustrates the effect on project size of both interdependency and indivisibility, and the influence of interest rates on the economic feasibility of the alternative proposals. The Alabama-Coosa program is

presented as a case where single-purpose basin development by a single utility can meet efficiency criteria because indivisibility is not a problem (i.e., the size of the potential development does not exceed the sponsoring utility's resources), but where questions of providing and paying the cost of flood control are not settled. The discussion of the Willamette case is another accounting *tour de force* in which the regional incidence of project costs and gains under three alternative types of institutional control (federal, local public, and private development with rapid tax amortization) are estimated in order to examine income redistributional effects in the light of both efficiency and equity considerations.

The skill of the analyses, however, can not offset the uncertainty of the basic data. The authors take pains to indicate their major assumptions, and data deficiencies and uncertainties are indicated frequently (although sometimes only in footnotes). Nevertheless, the real possibility exists that the precision with which the analyses are carried out will convey an impression of accuracy to the reader unfamiliar with the difficulties involved in identifying and measuring benefits and costs.

This reviewer has no objection to defining away—as the authors have done—many of the intractable problems of resource management: the importance to be attached to social, philosophic, and political objectives; the uncertainties in secondary and multiplier effects; the vagaries in the institutional framework under which allocation, rate-making, and repayment decisions are made. Such simplification is necessary to accomplish the objective of presenting models for economic analysis of the conditions represented by the three case studies. But within the framework of the stated objectives, questions may well be raised. We will illustrate some of the questions by examining in some detail one set of analyses: those dealing with the controversial Hells Canyon proposals.

The authors find that the federally proposed high dam (with large storage reservoir) has a higher benefit-cost ratio than the Idaho Power Company's three-lower-dam plan when the "conventional" federal interest charge of 2.5 per cent and amortization over 100 years are used. However, when the authors apply a rate of 5.5 per cent, their imputed social cost of federal financing, the three-dam plan is judged somewhat more efficient. A two-dam plan, intermediate in size, however, is found more efficient than either of the two proposals. (The two-dam plan was suggested by witnesses testifying in the Federal Power Commission hearings but was not proposed by any agency or utility.)

The data on which these analyses are based were "best consensus" estimates taken from the record of the FPC hearings, but it should be noted that there were many conflicting estimates and assumptions presented in the course of the lengthy controversy. There were conflicting estimates of power capacity, both at the site and downstream, of stream flow depletion by further irrigation developments upstream, of construction costs, of operating schedules and policies, of the size and morphology of the power systems into which the alternative proposals would be incorporated, and of the role of water storage in these systems. There were also conflicts over the estimates of markets for the potential power, of the forecasts of area and regional growth, and of the geographic incidence of benefits. The authors cut through these conflicts by accepting the "best consensus" estimates, but there is a difference between "consensus" and "best consensus." The really intractable questions have been assumed away—not answered. The authors speak to this point, but, as noted, the reader may lose sight of it under the impact of the quantitative analyses presented.

One detailed but crucial assumption concerns the degree of hydraulic and electrical integration of the proposals with the rest of the Northwest Power Pool. In comparing the high dam with the three low dams, the authors assume an identical degree of integration, and thus maximize the power output of both proposals. The Idaho Power Company's plan, however, did not propose or provide for full electrical or hydraulic integration. This fact was recognized in the authors' later comparison of the three-dam plan, operated as an isolated system, with a two-dam plan operated as an integral part of the Columbia River federal power system. This has the effect of maximizing the economic gain of the two-dam plan over the three-dam plan. *Had the same assumption been used in the comparison of the high vs. three-dam plans,* the high dam would have shown a favorable incremental benefit-cost ratio even at the 5.5 per cent interest rate.

Another crucial assumption is that the estimated unit value of prime power (taken as $41.58 per kilowatt) remains the same for all three plans, regardless of differences in the amount and geographic distribution of power marketed. This single-value criterion denies the effect of supply on value, and the existence of differential threshold effects on induced industrial load growth, of area specialization and comparative advantage, and of any general reorganization benefits.

The incremental benefit-cost analysis is also, as the authors state (p. 152), very sensitive to the assumed value per kilowatt. In the analysis, the assumed value per kilowatt of $41.58 need be increased only to $45.13 (in other words, by less than 9 per cent) to give the high dam a favorable incremental benefit-cost ratio over the three-low dams at the social interest rate of 5.5 per cent. It is very doubtful that our social accounting technology permits

evaluation of water project benefits within a range of accuracy of 10 per cent above or below an estimate. The reader will bear in mind that the critical estimate of $41.58 (representing the "value" of the Hells Canyon power) "was derived by the FPC staff by estimating the lowest cost of alternative nonhydroelectric power, on the assumption that the alternative thermal capacity would be built by some public body with investment funds available at 2.5 per cent." The same arguments advanced by the authors in support of their 5.5 per cent social interest rate would suggest that a rate of 2.5 per cent is too low in calculating the cost of the alternative. Indeed, public bodies are not at present able to obtain investment funds at such a low rate. This all leads to the conclusion that the cost of the alternative may have been understated, leading to an understatement of the value of Hells Canyon power, unless there were offsetting overstatements.

This reviewer endorses the principle that the economic analysis of water projects should be based on the alternative cost of the investment funds, that is, that a social interest rate on federal funds should be applied in the manner advanced by the authors. Nevertheless, one may question why the estimated rate is higher than local public agencies must pay for funds borrowed to construct roughly comparable projects in the same region such as Priest Rapids, Rocky Reach, and Wanapum. (The effective interest rate on five such recent projects has ranged from 3.23 to 5.11 per cent.) The financing of these projects is based on higher charges for power and shorter pay-out periods than those assumed by the authors for the high Hells Canyon Dam. A rational government, however, could adopt the same arrangements if faced with the alternative of applying a relatively high imputed social interest cost. The economic phase of project formulation would then take the form of maximizing benefits vs. minimizing interest cost by seeking the optimum combination of low power charge and fast pay-off period without necessarily having to reduce the size of the project below that size indicated under past financial practices. Or, put another way, the federal project would at least enjoy financing on the same basis as if it were built by a local public or private agency. It is not clear that application of the Krutilla-Eckstein estimate of a social interest rate does not subject the federal project to an artificial penalty. In passing, it should be noted that if a social interest rate is valid, it should be applied to all government investments in public works, including the vast Federal Interstate Highway program.

This leads to another question regarding the authors' assumption of a 100-year amortization period (p. 144). Such a long payout period may be indicated somewhere in the voluminous FPC record of the case. However, both the original Bureau of Reclamation project planning report (*The Columbia River*, Vol. 2, House Doc. 473, 81st Cong., 1950, p. 123) and the FPC *Decision* (William J. Costello, Presiding Examiner; May 6, 1955) (page 44) used a 50-year payout period. The interest savings from the shorter period would be greater in the case of the high dam than in the case of the less costly three-dam plan. It is not clear that assuming a payout period longer than 50 years is warranted.

The Krutilla and Eckstein analysis ignores another point that was the subject of much controversy in the long Hells Canyon debate: the timing of completion of construction. Proponents of the Idaho Power proposal argued that the smaller dams could be constructed and operating in a shorter period of time than the large Federal dam. Backers of the latter, on the other hand, pointed out that Idaho Power Company would not be required nor did it intend to construct all three of its proposed dams simultaneously (two are currently under construction). Adjustment for timing of construction is a very uncertain business, at best, and the authors understandably wished to avoid the complexity of comparing streams of benefits over time. Nevertheless, the proposal of Idaho Power practically guaranteed construction of the plan in two or more phases, and the high dam plan obviously called for a single, lengthy construction period. To treat both proposals as producing their full power benefits from the outset is a severe simplification.

In fact, the hypothetical situation assumed by the authors (i.e., federal development and integrated operation of both proposals with no phasing of construction and initial operation) is a severe abstraction. This abstraction is useful in illuminating economic differences in the basic physical plans; but is of limited use to the decision-maker faced with a choice between alternative proposals actually advanced by dissimilar agencies. The finding of the Hells Canyon analysis that one proposal is more efficient than another is only a minor finding, and is true only under certain assumptions. The major finding is that the institutional structure for decision-making was inadequate to implement the most efficient plan under the simplifying assumptions, and even after a "best" plan had been adumbrated. The implication is clear: three decades of "comprehensive river basin planning" have not produced optimal institutional structures and policies in the water resources field.

The book puts a heavy burden on the reader, who must continually distinguish between the reality of the data and the abstraction with which the data are used. The reality of the data and the maturity of the analysis will tempt the unwary reader into applying the authors' conclusions to reality rather than to the abstract model. He may easily miss such

admonitions as the footnote (p. 145) to the effect that ". . . our results should be regarded as useful only in illustrating some of the basic factors underlying efficient multiple purpose development, rather than a definitive determination of the most efficient plan of development for Hells Canyon."

If the reader is careful to respect the authors' qualifications and warnings, and to avoid conclusions and interpretations not intended and not supported by the abstracted analyses, the study is an excellent and suggestive demonstration of analytical possibilities. Taken as the authors intended, the book is a major contribution to resource development economics.

MARION E. MARTS

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*Etudes sur L'Etat d'Israël et le Moyen-Orient (1935–1958)*, BY JEAN GOTTMANN. 176 pp.; maps. Librairie Armand Colin, Paris, 1959. $9\frac{1}{2}$ x 6 inches.

The book contains eleven articles by the author published in France during 1935–1956 and an article contributed to the International Geographical Congress of Amsterdam (1938). These articles are assembled in approximately chronological order and are joined together by an introduction, comment on some of the earlier publications, and a new article "Ten Years after [the] Independence [of Israel]" written in 1958. The whole work is an excellent presentation of views and methods of the French School of Geography focused on a single area while elaborating problems of economic development faced at various stages by Jews, Arabs, and the British Government. Palestine and Israel after 1948 occupy the center of attention; other parts of the Middle East are only discussed for purposes of amplification or comparison. The book discloses much of the evolution of the author's regional geographical thinking which led to his writing "Virginia at Mid-Century" (1955).

Gottmann states in the introduction that "Israel proves that the process of expansion by European population groups is not over" (p. 6). In Israel he shows this expansion to be cast in a framework of Russian socialist and nationalist ideologies dating from the period 1900–1910, when the creators of the new state received their schooling in Imperial Russia. This ideology resulted in the use of communal villages in early stages of settlement and in the modern growth of industrial cooperatives. It permitted the rapid geographical dispersal of Jewish settlement, the ready adoption of agricultural methods from other cultural groups (e.g., use of well irrigation from Arabs, p. 34; dairying from nineteenth century German Christian settlers, p. 43, etc.) and assimilation of both other European and non-European Jews. The chronological order of the articles permits observing the impressive expansion of agricultural activities south of Tel Aviv in the direction of Beersheba. For these and other reasons Gottmann rejects concepts of absorptive capacity promulgated primarily by the British Government which did not even prepare a master plan for the use of water resources. Indeed the book demonstrates the insufficiency of deterministic geographical concepts in the face of human will power, organization, and finance. But the author also states that, "There must be population pressure to create the pioneering spirit which makes the appeal of virgin lands irresistible" (p. 90). This population pressure may now restore to cultivation those areas formerly irrigated that were abandoned when the trade routes of antiquity decayed.

Unfortunately, the author does not discuss the thesis of D. H. K. Amiran ("The Pattern of Settlement in Palestine," in *Israel Exploration Journal*, Vol. 3, Numbers 3 and 4, Jerusalem, 1953) that settlement of marginal dry regions is a function of political security. According to this thesis, security of property, etc., is now permitting rapid expansion of settlement into dry zones. Gottmann, however, contributes to the discussion of possibilities of settlement an interesting geographical description of a system of irrigation formerly practiced in the area southwest of Beersheba (p. 85). Being concerned with the geography of the expansion of European or Europeanized population groups, the author does not discuss the problems of Arab refugees, nor details of the relatively high costs of Israeli agriculture and industry. Despite these omissions, which are inherent in the aim of the articles, Gottmann presents a concise picture of the evolution of land use and its organization in Israel.

ALEXANDER MELAMID

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*Seaports South of Sahara: The Achievements of an American Steamship Service*, by ROBERT GREENHALGH ALBION. xii and 316 pp.; illus., tables, index. Appleton-Century-Crofts, Inc., New York, 1959. $6.00. $9\frac{1}{2}$ x $6\frac{1}{4}$ inches.

Dr. Albion, Gardiner Professor of Oceanic History and Affairs, Harvard University, has three main themes running through this book: (1) "a summary account of American maritime policy," particularly since 1914; (2) "an area study of the coasts and commerce" of Sub-Sahara Africa; and (3) "an account of the American-flag steamship service to those regions," more especially of what is now the Farrell Lines. An ambitious task, indeed almost a tour de force, the author deserves high marks for the skill and fluidity of his presentation.

Chapter I presents a brief background of the

American merchant marine in decline from the Civil War until World War I. This historical thread is picked up again in Chapter IV, depicting the "return to the sea" of the American merchant fleet, started in World War I and maintained after 1920 by government support of liner services on "essential trade routes" to all important ports of the world. In succeeding chapters the history of the Farrell Lines and the history of American merchant marine policy are closely interwoven, the former serving as an illustration or case study of the latter. The reader, as it were, gets two histories for the price of one.

Dr. Albion concludes that the concept of "essential trade routes" has been a valuable one to the United States, continuing its flag representation on the high seas at a cost in subsidies amounting, in the case of the African services, to only about one per cent of the value of American goods exported on those essential routes. Initiative of the shippers is also credited with stimulating the carriage of many cargoes which might not otherwise have been moved, at least between Africa and America. One occasionally wonders, however, whether there is complete consistency in his criticism of various forms of nationalistic economic behavior in foreign countries and his support for continuing subsidy to high-cost American shippers. The recent enormous increase in registry under flags of convenience is also perhaps slighted, and particularly the part played by Farrell Line officials in starting Liberia in this controversial but remunerative field.

The "area study" theme is begun in Chapter II, devoted to major cargoes moving to and from Africa. It is noted that trade between the United States and Africa South of the Sahara increased 3600 per cent in value from 1913 to 1948, a rate of growth far greater than that for United States trade with any other continent. Chapter III presents a brief summary of the ports of Africa from Cape Town to Zanzibar, while those from Dakar to Lobito are treated in Chapter XI, more closely juxtaposed with the chapter devoted to the Farrell Lines' more recent development of services on the West African run.

Perhaps the most valuable contribution of this book is its presentation of the multi-faceted concerns of the shipping industry. In contrast with the railroads, fixed in route and thus tending to breed conservatism, the merchant fleet operators must show remarkable elasticity, for their ships, their cargoes, and their ports of call change with sometimes alarming rapidity. The first full account of an American steamship service in foreign trade, this book has relatively little strictly geographic content, but a wealth of material of direct and peripheral interest to those geographers interested in sea transport in general or in Africa in particular.

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